DRAFT SAMPLING ANALYSIS PLAN

# Cuyahoga River Gorge Dam Great Lakes Legacy Act Project, Cuyahoga Falls, Ohio

## Remedial Design, EPA GLAES Contract Task Order 68HE0518F0667/Contract No. EP-R5-11-09

*Prepared for*

EPA
United States
Environmental Protection
Agency

~~August~~ October 2019

[ SHAPE * MERGEFORMAT ]

CH2M HILL, Inc.
1610 N 2nd Street
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Milwaukee, WI 53212

**Draft Sampling Analysis Plan**
**Cuyahoga River Gorge Dam GLLA Project**
**Task Order 68HE0518F0667, Contract Number EP-R5-11-09**

Prepared by: CH2M — Date: October~~August~~ 2019
Approved by:

__________________________________________________
EPA, GLNPO — Date
Contracting Officer's Technical Representative
Mary Beth Giancarlo

__________________________________________________
EPA, GLNPO — Date
Great Lakes Legacy Act Quality Assurance Lead
Mark Loomis

__________________________________________________
CH2M — Date
Project Manager
Julie Schucker

__________________________________________________
CH2M — Date
Quality Assurance Manager
Jewelle Keiser

__________________________________________________
Aqua Survey~~<Sediment Sampling Subcontractor – TBD>~~ — Date
Project Manager
Tom Dolce ~~<insert name>~~

**Commented [SJ1]:** Mark Loomis: Providing all information missing from this draft, including identification of subcontractors and analytical laboratories that are currently identified as "TBD", and adding the analytical laboratory Standard Operating Procedures (SOPs) to Appendix A;

**Commented [AB2R1]:** Added

__________________________________________________
Seaworks Group — Date
Project Manager
Chris Ebner

__________________________________________________
Mateco Drilling — Date
Project Manager
Todd M. Johansen

APPROVAL PAGE

In-Situ Soil Testing Date
Project Manager
Roger Failmezger

GPD Date
Project Manager
Matthew Lascola

~~<chemical laboratory – TBD>~~ALS Environmental Holland Date
Project Manager
~~<insert name>~~Chad Whelton

~~<chemical laboratory – TBD>~~ ALS Environmental Holland Date
Quality Assurance Manager ~~nd Project Manager~~
Chad Stolke ~~<insert name>~~

**Commented [SJ3]:** Mark Loomis: Providing all information missing from this draft, including identification of subcontractors and analytical laboratories that are currently identified as "TBD", and adding the analytical laboratory Standard Operating Procedures (SOPs) to Appendix A;

**Commented [EJ4R3]:** verified

**Commented [KJ5]:** So is he the lab PM or is it the other Chad?

**Commented [SJ6R5]:** revised

**Commented [SJ7]:** Mark Loomis: Providing all information missing from this draft, including identification of subcontractors and analytical laboratories that are currently identified as "TBD", and adding the analytical laboratory Standard Operating Procedures (SOPs) to Appendix A;

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~~<Lab Name>~~ ALS Environmental Holland Quality Assurance Manager
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**Commented [AB10R9]:** Added

**Commented [SJ11]:** Mark Loomis: Providing all information missing from this draft, including identification of subcontractors and analytical laboratories that are currently identified as "TBD", and adding the analytical laboratory Standard Operating Procedures (SOPs) to Appendix A;

**Commented [AB12R11]:** Added

**Commented [SJ13]:** Mark Loomis: Providing all information missing from this draft, including identification of subcontractors and analytical laboratories that are currently identified as "TBD", and adding the analytical laboratory Standard Operating Procedures (SOPs) to Appendix A;

**Commented [EJ14R13]:** verified

# Contents

Section Page

**[ TOC \o "2-3" \h \z \t "Heading 1,1,Acronyms and Abbreviations,1" ]Appendixes**



**Commented [SJ15]:** Mark Loomis: Table of Contents – From Section 2.1.2 of the Table of Contents (Sediment Sampling) through the end of Section 2, the titles and numbering do not correspond with those in the text of the SAP. As a result, several references to "Section 2" sections in the text reference incorrect section numbers. The remaining SAP sections (3, 4, 5, and 6) are all correctly labeled and numbered.

**Commented [SJ16R15]:** TOC revised

**Commented [GMB17]:** Attach to SAP.

**Commented [SJ18R17]:** Added

**Commented [SJ19]:** Mark Loomis: Providing all information missing from this draft, including identification of subcontractors and analytical laboratories that are currently identified as "TBD", and adding the analytical laboratory Standard Operating Procedures (SOPs) to Appendix A;

Table of Contents, Appendix A – No SOPs were provided in Appendix A (Analytical Laboratory Standard Operating Procedures) of this draft SAP.

**Commented [EJ20R19]:** Lab SOPs added to Appendix

# Acronyms and Abbreviations

| | |
|---|---|
| °C | degree Celsius |
| µg | microgram |
| ASTM | ASTM International |
| bgs | below ground surface |
| BODR | basis of design report |
| COTR | contracting officer's technical representative |
| CPT | cone penetration test |
| DPT | direct-push technology |
| DQO | data quality objective |
| EDD | electronic data deliverable |
| EPA | U.S. Environmental Protection Agency |
| EQuIS | Environmental Quality Information System |
| FOP | field operating procedure |
| GIS | geographic information system |
| GLLA | Great Lakes Legacy Act |
| GLNPO | Great Lakes National Program Office |
| GLSED | Great Lakes Sediment Database |
| GPS | global positioning system |
| HASP | health and safety plan |
| IDW | investigation-derived waste |
| LCS | laboratory control sample |
| LIDAR | light detection and ranging |
| LIMS | laboratory information management system |
| MDL | method detection limit |
| MS | matrix spike |
| MSD | matrix spike duplicate |
| MVS | mining visualization system |
| PAH | polycyclic aromatic hydrocarbon |
| PARCC | precision, accuracy, representativeness, completeness, and comparability |
| PCB | polychlorinated biphenyl |
| PCN | polychlorinated naphthalene |
| PDF | portable document format |
| PPE | personal protective equipment |

| | |
|---|---|
| QA | quality assurance |
| QAM | quality assurance manager |
| QAPP | quality assurance project plan |
| QC | quality control |
| RCRA | Resource Conservation and Recovery Act |
| RD | remedial design |
| RF | response factor |
| RL | reporting limit |
| RPD | relative percent difference |
| SAP | sampling and analysis plan |
| SDG | sample delivery group |
| SOP | standard operating procedure |
| SOW | Statement of Work |
| SPT | standard penetration test |
| SVOC | semivolatile organic compound |
| TCLP | toxicity characteristic leaching procedure |
| TSS | total suspended solids |
| VOC | volatile organic compound |

# Introduction

The U.S. Environmental Protection Agency (EPA) requires parties that conduct environmental monitoring and measurement efforts mandated or supported by the EPA Great Lakes National Program Office (GLNPO) to participate under a centrally managed sampling and analysis plan (SAP), which includes a quality assurance project plan (QAPP) and field sampling plan. This SAP was developed in general accordance with the R9QA/009.1 *Sampling and Analysis Plan Guidance and Template* (EPA, 2014), which combines the basic components of a QAPP and a field sampling plan, and *Contaminated Sediment QA Consideration V.9* (EPA, 2019) as well as observations and information obtained during the site reconnaissance conducted on September 25, 2019. Parties generating data under this program must implement procedures so that the precision, accuracy, representativeness, completeness, and comparability (PARCC) of their data are known and documented. Project participants, including subcontractors, must follow the procedures and protocols outlined in this SAP.

This SAP presents the basic elements of a QAPP and field sampling plan, including project team organization (Figure 1), objectives, functional activities, and specific quality assurance (QA) and quality control (QC) activities for remedial design (RD) activities being conducted at the Cuyahoga River Gorge Dam ~~(Estimated Sediment Removal Limits)~~ pool and sediment disposal area (Chuckery ~~Disposal~~ Area). The project is located in the Cascade Valley South Metro Park and Gorge Metro Park as shown on Figure 2.

Section 1 provides an overall approach for managing the project and describes the following components:

- Project organization, roles, and responsibilities
- Problem definition and background information
- Project description and schedule
- Data quality objectives (DQOs) and criteria for measuring data
- Instructions for special training requirements and certification
- Instructions for documentation and records management

## 1.1 Project Organization

The project team and key project personnel is presented in the following sections. The work is being conducted for EPA GLNPO in accordance with the Statement of Work (SOW) (dated September 11, 2018) and Modification 1 (dated June 19, 2019).

A copy of this SAP will be provided to the field team members, including subcontractors, for their review and will be available onsite during sampling. In addition, the objectives and requirements of the SAP will be communicated to project team members during the project kickoff call prior to sampling. The relevant SAP requirements will also be communicated to CH2M's laboratory and treatability testing subcontractors.

### 1.1.1 EPA GLNPO Contracting Officer's Technical Representative

Mary Beth Giancarlo, EPA's contracting officer's technical representative (COTR), has overall responsibility for all phases of the project. The COTR also is responsible for reviewing this SAP.

**Commented [SJ21]:** Mary Beth: We should talk about incorporating any changes that result from the field recon – like, change to proposed pipeline route, changes to sampling locations, identification of access points and/or additional staging areas. If these can be incorporated into the SAP before your next submission, great, but if not, then maybe Drew can put together a summary of the recon for the record.

**Commented [WD22R21]:** Revised text for additional pipeline termination surveying.

Changes to sampling locations, identifying access points and staging (drilling only) are shown in revised Figure 4.

Changes/updates per site recon activities, are noted "per recon" throughout.

**Commented [SJ23]:** Updating the Project Organization Chart to ensure that all organization names are identified, including those currently labeled "TBD"; ensuring the names of the key personnel in the Project Organization Chart are similarly identified and their roles described in Section 1.1 (Project Organization); and that all personnel with key roles described in the SAP are listed in Section 1.1; and

Section 1.1, Figure 1 – Some of the individuals identified in the Figure 1 Project Organizational Chart are not included in Section 1.1 (Project Organization). Examples include Karla Auker (no title), Krista Heartwell (CO), and Latrice Haggerty (Contracting Specialist) from EPA; Adrienne Korpela (APgM), Tim Watkins (MOP); Whitney Smith (SubKA); Dan Plomb (SMEs) of the CH2M GLAES Program; and Bill Andrae, CH2M Sediment Remediation Lead. Also, the titles of several staff in Section 1.1 do not match those in the Project Organizational Chart, as are noted in the pdf. The names and titles of the key personnel in Section 1.1 and those in the Project Organizational Chart should correlate and be consistent.
Section 1.1, Figure 1 – The following individuals identified in Section 1.1 (Project Organization) are not shown on the corresponding Figure 1 Project Organization Chart: CH2M Health and Safety Manager Carl Woods; CH2M Field Team Member Raja Kaliappan; CH2M Database Manager Rick Dobbins; CH2M Geographic Information Systems (GIS) and Mining Visualization System (MVS) Analyst Mark Petershack; and CH2M Administrative Assistant Tracy Cooper.

Mark Loomis: The following discrepancies were identified in the Figure 1 Project Organizational Chart:
Many of the boxes in the Chart do not identify the organization name (e.g., EPA GLNPO, CH2M, Maetco, etc.), and therefore it's unclear as to which organization several of the individuals in the Chart work for.
The title of the CH2M's Quality Assurance Manager (QAM), Jewelle Keiser, in the Project Organization Chart is labeled "Quality", rather than CH2M QAM. Also, Ms. Keiser is in the box titled GLAES Program Team Support along Whitney Smith, subcontract administrator. Independence from day-to-day activities for the project QAM would be better represented if displayed in a separate quality assurance manager box.
The title for Mr. Drew Walter in the Project Organization Chart (Disposal Area Lead) does not correspond to any of the three project titles he is assigned in Section 1.1, which include CH2M Assistant Project Manager, Field Team Leader, and Site Safety Manager. Title assignments should be consistent throughout ...

**Commented [SJ24R23]:** Text revised and figure 1 revised

**Commented [GMB25]:** ?

**Commented [SJ26R25]:** Revised text

### 1.1.2 EPA GLNPO Great Lakes Legacy Act Quality Assurance Lead

Mark Loomis, EPA GLNPO Great Lakes Legacy Act (GLLA) QA lead or designee is responsible for reviewing and approving this SAP.

### 1.1.3 CH2M Program Manager

Gina Bayer, CH2M's program manager, has overall responsibility for meeting EPA's objectives and CH2M's quality standards, as well as technical QC and project oversight.

### 1.1.4 CH2M Quality Assurance Manager

Jewelle Keiser, CH2M's quality assurance manager (QAM), has the following responsibilities:

- Direct the QA review of the various phases of the project, as necessary.
- Direct the review of QA plans and procedures.
- Provide QA technical assistance to project staff, as necessary.

The CH2M QAM functions independently of the project staff and has direct access to management staff to resolve QA disputes, as necessary. The CH2M QAM will remain independent of direct day-to-day operations during the investigation.

### 1.1.5 CH2M Project Manager

Julie Schucker, CH2M's project manager, is responsible for implementing the project. She is authorized to commit the resources necessary to meet project objectives and requirements. Her primary function is to achieve the technical, financial, and scheduling objectives of the project. She will report directly to the COTR and will be the main point of contact for matters concerning the project. The project manager has the following responsibilities:

- Define project objectives and develop a detailed work plan and schedule.
- Establish project policy and procedures to address the specific needs of the project as a whole and also the particular objectives of each task.
- Acquire and apply technical and corporate resources to meet budget and schedule constraints.
- Orient field leaders and support staff to the project's special considerations.
- Monitor and direct other team members.
- Develop and meet ongoing project or task staffing requirements, including mechanisms for reviewing and evaluating each task product.
- Review the work performed on each task to ensure quality, responsiveness, and timeliness.
- Review and analyze overall task performance with regard to the planned schedule and budget.
- Review external reports (deliverables) before submission to EPA.
- Represent the project team at meetings and public hearings.
- Ensure the project plans (SAP and health and safety plan [HASP]) and field operating procedures (FOPs), and other project reports are prepared as required and the appropriate project staff are engaged.
- Verify that EPA-requested changes or updates have been incorporated into the project plans and reports.

### 1.1.6 CH2M Assistant Project Manager

Drew Walter, CH2M's assistant project manager, will assist the project manager in producing a quality work product within the authorized schedule and budget. To accomplish that goal, the assistant project manager will:

- Organize, direct, and oversee personnel and resources in the absence of the project manager, and perform tasks delegated by the project manager.
- Monitor subtask progress, quality, and adherence to authorized budgets and schedules.
- Serve as the second point of communication with the EPA contract management team—the COTR, project officer, contracting officer, and the CH2M internal program management team, including the program manager, QAM, and contract administrator—as necessary to keep them apprised of progress.

### 1.1.7 CH2M Senior Technical Consultant

Marty Reif, CH2M's senior technical consultant, will support the project manager as a technical resource and will be the engineer of record for the overall project designs. The senior technical consultant will participate in ongoing work in his areas of technical expertise and will be a point of communication with the EPA team.

### 1.1.8 CH2M Design Manager and Sediment Remediation Lead

Bill Andrae, CH2M's design manger and sediment remediation lead, will be responsible for developing remedy and managing the designs for the sediment removal and disposal areas. He will participate with the project team in discussions, especially the engineer of record.

### ~~1.1.8~~1.1.9 CH2M Field Team Leader

Drew Walter, CH2M's field team leader, will be responsible for field planning activities, coordination and oversight of the field effort. The field team leader will:

- Verify that field staff training requirements have been met.
- Arrange for field equipment and supplies.
- Oversee CH2M staff during the field effort.
- Serve as the primary point of communication with subcontractor staff and the CH2M project chemist regarding field-related logistics.
- Provide daily status updates to the CH2M project manager during the field effort.
- Verify that field documentation is appropriately maintained and tracked during and after the field effort.

### ~~1.1.9~~1.1.10 CH2M Health and Safety Manager

Carl Woods, CH2M's health and safety manager, will be responsible for developing the project-specific HASP. The health and safety manager also support the field team during field activities.

### ~~1.1.10~~1.1.11 CH2M Site Safety Coordinator

Drew Walter, CH2M's site safety coordinator, will be responsible for distributing the HASP to the field team and subcontractors and ensure implementation during fieldwork.

### ~~1.1.11~~1.1.12 CH2M Field Team Member

Raja Kaliappan, CH2M's field team member, will be responsible for completing daily tasks and ensuring work is completed in compliance with this SAP.

### ~~1.1.12~~1.1.13 CH2M Sample Manager

Jaime Engle, the CH2M sample manager, is responsible for entering the field- and analytical-collected data into the Scribe database in accordance with the *Great Lakes Legacy Act Data Reporting Standards* (EPA, 2010). The CH2M sample manager will enter sample management data daily during the field event into Scribe, and the field data will be entered into Scribe at the conclusion of the sampling event.

### ~~1.1.13~~1.1.14 CH2M Project Chemist

Jaime Engle, CH2M's project chemist, will be responsible for tracking analytical data and overseeing the data evaluation. Her specific responsibilities include the following:

- Schedule and coordinate activities with the analytical laboratory(s).
- Oversee tracking of samples and data from the time of field collection until results are reported to GLNPO at the end of the project.
- Coordinate and oversee data verification, validation, and production of data deliverables.
- Coordinate independent validation with GLNPO and GLNPO's validation contractor.
- Evaluate usability of merged field and laboratory data.
- Prepare data usability report, incorporating the results of the independent validation.
- Prepare Great Lakes Sediment Database (GLSED) deliverable.

### ~~1.1.14~~1.1.15 CH2M Database Manager

Rick Dobbins, CH2M's database manager, will provide data management support, including management of the project database, upload field and analytical data, prepare the validated data set for independent validation, incorporate the results of the independent validator, prepare data tables for reporting, and prepare the GLSED electronic data deliverables (EDD) compliant with the *Great Lakes Legacy Act Data Reporting Standard* (EPA, 2010). Additional responsibilities are presented in Section 2.12.1.

**Commented [SJ27]:** Mark Loomis: Sections 1.1, 2.12.1 – The roles and responsibilities for CH2M Database Manager Rick Dobbins and CH2M Geographic Information System and Mining Visualization System Analyst Mark Petershack are described in two places of the SAP: in Section 1.1 (Project Organization) and in Section 2.12.1 (Data Management Plan, Team Organization and Responsibilities). It's recommended that each of these sections reference the other so that any discrepancies in responsibilities between the sections are addressed.

**Commented [SJ28R27]:** Text added

### ~~1.1.15~~1.1.16 CH2M Geographic Information System and Mining Visualization System Analyst

Justin Hansen~~Mark Petershack~~, CH2M's geographic information systems (GIS) and mining visualization system (MVS) analyst, will coordinate with the project manager to set up a geodatabase before sampling, and is responsible for maintaining spatial layers and overall geodatabase integrity and accuracy, and providing GIS- and MVS-related deliverables for reports and outputs for computer-aided design figures for the RD. Additional responsibilities are presented in Section 2.12.1.

**Commented [SJ29]:** Mark Loomis: Sections 1.1, 2.12.1 – The roles and responsibilities for CH2M Database Manager Rick Dobbins and CH2M Geographic Information System and Mining Visualization System Analyst Mark Petershack are described in two places of the SAP: in Section 1.1 (Project Organization) and in Section 2.12.1 (Data Management Plan, Team Organization and Responsibilities). It's recommended that each of these sections reference the other so that any discrepancies in responsibilities between the sections are addressed.

**Commented [SJ30R29]:** Text added

### ~~1.1.16~~1.1.17 CH2M Administration Assistant

Tracy Cooper, CH2M's administrative assistant, will be responsible for maintaining project documentation and assisting in deliverables for reports.

### ~~1.1.17~~1.1.18 V~~S~~vibracore~~sediment~~ Sampling and Analysis~~Testing~~ Subcontractor—Aqua Survey~~TBD~~

Aqua Survey's project manager, Tom Dolce, ~~<insert name of subcontractor and PM>~~, is responsible for coordinating and scheduling subcontractor activities for sediment drilling and sampling, geotechnical testing, and treatability testing services-. He is responsible for implementing relevant portions of the SAP and overseeing sediment sampling and testing activities. The project manager is responsible for reviewing and providing sampling documentation for each location, such as location coordinates, penetration and recovery depths, necessary for logging of sediment cores to CH2M during the field effort. The project manager will also be responsible for the collection, shipping, and analysis of geotechnical and treatability samples.

**Commented [SJ31]:** Mark Loomis: Providing all information missing from this draft, including identification of subcontractors and analytical laboratories that are currently identified as "TBD", and adding the analytical laboratory Standard Operating Procedures (SOPs) to Appendix A;

**Commented [AB32R31]:** Added

### 1.1.19 Bathymetry Subcontractor – Seaworks Group

Chris Ebner, Seaworks Group project manager is responsible for coordinating and scheduling field activities for bathymetric services. He is responsible for implementing relevant portions of the SAP and overseeing bathymetric activities.

### ~~1.1.18~~1.1.20 SPT Drilling ~~Geotechnical Sampling~~ and Geotechnical Laboratory Subcontractor—Mateco Drilling

Todd Johansen, Mateco's project manager is responsible for coordinating and scheduling subcontractor activities for geotechnical drilling services. He is responsible for implementing relevant portions of the SAP and overseeing drilling activities. The project manager is responsible for reviewing and providing drilling measurements such as logging information at each sample location to CH2M during the field effort. The project manager will also be responsible for the collection, shipping, and analysis of geotechnical samples.

### 1.1.21 CPT Sounding Subcontractor—In-Situ Soil Testing

Roger Failmezger, In-Situ Soil Testing project manager is responsible for coordinating and scheduling subcontractor activities for CPT sounding services. He is responsible for implementing relevant portions of the SAP and overseeing sounding activities.

### 1.1.22 Topographic Survey Subcontractor– GPD

Matthew Lascola, GPD project manager is responsible for coordinating and scheduling field activities for topographic services. He is responsible for implementing relevant portions of the SAP and overseeing toporgraphic activities.

### ~~1.1.19~~1.1.23 Analytical Laboratory Project Manager – ALS Environmental Holland

~~<Lab PM>~~ Chad Whelton/~~<Lab Name>~~ALS Environmental Holland, the laboratory project manager is responsible for coordinating and scheduling the sample analyses, handling communications between support laboratories, accepting requirements outlined within this SAP, and overseeing the data review and preparation of analytical reports. The laboratory project manager will conduct a final data review to check that all required analyses were performed on all samples and that all documentation is complete. The laboratory project manager will be responsible for releasing data to CH2M that cannot be released without the laboratory's approval.

**Commented [SJ33]:** Mark Loomis: Providing all information missing from this draft, including identification of subcontractors and analytical laboratories that are currently identified as "TBD", and adding the analytical laboratory Standard Operating Procedures (SOPs) to Appendix A;

**Commented [EJ34R33]:** verified

### ~~1.1.20~~1.1.24 Analytical Laboratory Quality Assurance Manager – ALS Environmental Holland

Chad Stoike ~~<Lab QAM>~~/~~<Lab Name>~~ALS Environmental Holland, the laboratory QAM is responsible for ensuring the quality of data received by CH2M and verifying laboratory conformance with this SAP.

**Commented [SJ35]:** Mark Loomis: Providing all information missing from this draft, including identification of subcontractors and analytical laboratories that are currently identified as "TBD", and adding the analytical laboratory Standard Operating Procedures (SOPs) to Appendix A;

**Commented [EJ36R35]:** verified

## 1.2 Problem Definition and Background Information

The overall project objective is to address the impairment of aquatic life and reestablish natural conditions along the middle and lower segments of the Cuyahoga River through sediment removal and decommissioning/removal of the Gorge Dam (dam removal design under separate contract), which will contribute to removal of beneficial use impairments in the Cuyahoga River area of concern.

The Gorge Dam was identified in the *2008 Integrated Water Quality Monitoring and Assessment Report* (Ohio Environmental Protection Agency, 2008) as a significant contributor to nonattainment of the state's water quality standards due to habitat alteration and hydraulic modification. In efforts to restore the Cuyahoga River, the Ohio Environmental Protection Agency and local stakeholders are collaborating to have the dam removed. Prior to dam removal, accumulated sediments of which a significant portion is contaminated (i.e., above screening levels) will need to be properly managed ~~due to significant portion contaminated above screening levels~~. Initial studies estimate that approximately 832,000 cubic yards of sediment (with a maximum sediment thickness of about 32 feet) has accumulated in the Gorge ~~d~~Dam pool that extends about 1.5 miles upstream of the dam (Battelle, 2012). This volume will be updated based on information collected as part of execution of this SAP.

**Commented [GMB37]:** Should mention somewhere in this paragraph that a significant portion of this sediment is considered contaminated (i.e., above screening criteria).

**Commented [SJ38R37]:** See revised text

The remedy selected for removing the sediment was presented in a 2015 feasibility study (Tetra Tech, 2015), which evaluated multiple dredging, dewatering, and disposal alternatives to complete the removal in the dam pool area (includes area approximately 1.5 miles upstream from dam). The selected remedy included hydraulic dredging with sediment dewatering using geotextile bags, onsite weep water treatment, and dredge material disposal at the Chuckery Area ~~located in the Cascade Valley South Metro Park.~~ (Figure 2).

The data collected during the field investigation will be used to support the remedial design (RD) of the sediment remedy that ~~and~~ will be divided ~~include~~ two separate design packages. The first ~~One~~ package will include ~~for~~ the ~~one for~~ sediment removal, transport, dewatering and the other will cover ~~one for~~ the construction of the containment ~~area~~ facility. Each design package will have its own unique set of drawings, specifications ~~list~~, and cost estimate. The approach, assumptions, parameters, and technical evaluations for the sediment remedy (i.e., sediment removal and containment cell construction) ~~Both designs~~ will be presented ~~discussed~~ in a single basis of design report (BODR).

he sediment removal area encompasses the Cuyahoga River Gorge from the upstream extent of the dam pool (Cuyahoga River mile 46.5) downstream to the dam structure (Cuyahoga River mile 45.0). The supporting operations area (such as the sediment dewatering and dredge material disposal area) will be located outside the Cuyahoga River dam pool~~Gorge~~. The Highbridge Trail ~~A southern upland area~~ has been identified for dredge material transport pipeline and a portion of the Cascade Valley South Metro Park, ~~where~~ the Chuckery Area, will be used for dewatering and disposal (Figure 2).

**Commented [SJ39]:** Need to ask Mary Beth why this is highlighted yellow

**Commented [SJ40R39]:** Made text change per 10-7-19 conversation

# 1.3 Project Description and Schedule

## 1.3.1 Project Description

The field investigation is designed to gather information to support development of the RD, and to address data gaps identified in the *Data Gaps Assessment—Cuyahoga River Gorge Dam Great Lakes Legacy Act Project, Cuyahoga Falls, Ohio Technical Memorandum* (CH2M, 2019) and provided ~~attached~~ in Appendix A. The description of the field investigation has been divided into the collectioning of sediment characterization data in support of the hydraulic dredging and dewatering design and geotechnical data for the design of the sediment disposal area. Table 1 presents data gap field activities related ~~connected to~~ specific design elements. In addition, a site reconnaissance was performed on September 25, 2019 to discuss field access for sampling activities. Reference to information discussed during this site visit is identified in this SAP.

## 1.3.2 Dam Pool Sediment Collection and Testing

Sediment collection activities will be conducted to gather physical data of the sediments from the Gorge Dam pool that will be used to define the technical approach and parameters in the hydraulic dredging and sediment dewatering design. In addition, treatability testing will be conducted to provide data for the design of the geotextile tube dewatering system or an alternative consideration/value-added element (Pneumatic Flow Tube Mixing Dewatering Method) that was identified in the data gaps assessment (Appendix A)~~*Data Gaps Assessment—Cuyahoga River Gorge Dam Great Lakes Legacy Act Project, Cuyahoga Falls, Ohio Technical Memorandum* (CH2M, 2019) and attached in Appendix A~~ and the temporary water treatment system.

A bathymetric survey, performed by Seaworks Group, of the Gorge Dam river pool will be conducted approximately 1.25 miles upstream of the Gorge Dam. This survey will be used to establish the baseline ~~for~~ sediment volume requiring removal and disposal~~calculations~~. A topographic survey, performed by GPD, will be conducted along the river banks of the Cuyahoga River using light detection and ranging (LIDAR) aerial techniques, due to steep terrain. This survey will be tied into the bathymetric survey providing a continuous survey at the water's edge.

Based on sediment characterization data from the previous ~~samplinge~~ investigation ~~locations~~ and the extent of the sediment to be removed, 16 supplemental sample locations were identified and shown in Figure 3. Examination of the sediment characteristics, such as grain size or other physical parameters from the previous investigation did not identify a ~~Overall there was not~~ substantive variation ~~observed in the physical characteristics of~~ in the sediment ~~such as grain size and other physical parameters~~ that could impact dewatering of the dredge material. ~~, as reported in the Battelle report, so t~~The proposed locations are ~~primarily based on the sediment thickness map from the Battelle 2012 report. The locations are~~ biased toward ~~where the~~ areas with the greatest thickness and volume of sediment are to be removed ~~is located~~.

Sediment collection activities will include:

- Collection of sediment at the 16 discrete sediment core sample locations. The material from a single boring from each of two adjacent sediment core sample locations ~~borings~~ will be combined into one composite sample resulting in~~to~~ a total of eight composite sediment samples. Logging of the sediment cores (maximum of 20 feet in length) will provide field observations of grain size and physical parameters that could impact dewatering of the dredged material.

**Commented [GMB41]:** Need to add a subsection to discuss topographic surveying activities of the proposed pipeline route. May have to survey other areas in order to avoid cultural or ecological significant resources.

**Commented [WD42R41]:** Added section on surveying. Surveying more than one option to terminate into the disposal area is a change of scope. Change made Per 10/2/19 phone call with EPA

**Commented [SJ43R41]:** Per 10-7-19 to include text that cultural area information will be included with field surveying to support design

**Commented [GMB44]:** I would also mention that this data/info will be used to support the evaluation of a couple of alternative considerations/value-added elements that were identified in the data gaps memo.

**Commented [AB45R44]:** Revised to singular option and relocated in 1.3.2

**Commented [GMB46]:** Attach to SAP.

**Commented [SJ47R46]:** See revised text

**Commented [SJ48]:** Mary Beth comment: The cross-walk that is Table 1 in the tech proposal is great and I would consider adding that to the SAP as well.

**Commented [SJ49R48]:** Table added.

**Commented [GMB50]:** Include bathymetric survey of dam pool and topographic survey (LIDAR?) of river banks in this section.

**Commented [WD51R50]:** Added section 1.3.2.1

**Commented [KJ52R50]:** Since also not just sediment collection and testing can we change to Dam Pool Sediment Investigation?

**Commented [SJ53R50]:** No. had many discussions with client and team that the word "investigation" won't be used.

**Commented [GMB54]:** Should we also mention here that this data will be used to evaluate different dewatering systems?

**Commented [AB55R54]:** Revised text to mention the evaluation of the alternative consideration for sediment dewatering noted in the data gap memo.

**Commented [GMB56]:** See comment above. Include a little bit more detail of how these locations were chosen (i.e., based on sediment thickness, grain size data, number of locations in each stratum, etc.)?

**Commented [SJ57R56]:** Text added.

**Commented [GMB58]:** Kind of confusing. Maybe describe as a single boring from each of two stations…

**Commented [AB59R58]:** Text revised.

- Surface water samples will also be collected from the Gorge Dam pool at the same 16 discrete sediment core sample locations and composited, resulting in eight water samples.
- An estimated 10 gallons of sediment and 20 gallons of water are needed for each of the eight composited sediment samples for treatability testing.
- An estimated 5 gallons of sediment are needed for each of the eight composited sediment samples are needed for geotechnical testing.

- Field and testing activities include:
- Collect water depth and conduct sediment probing to refusal at the 16 locations within the Gorge dam pool to identify potential obstructions (such as rip rap or other debris) prior to sampling and determine the approximate boring depth. The water depth and probing data will help ~~be used~~ to define the sediment thickness and dredge cut elevations.
- Conduct sediment coring to a maximum ~~bottom of~~ sediment column depth ~~length~~ of 20 feet at the 16 locations and select samples to create 8 composited sediment samples representative of the ~~entire~~ sediment profile from the 16 locations and bulk water from the Gorge Dam pool for treatability testing. Depending on the diameter of sampler used and sediment recovery, additional cores may be conducted to obtain the required volume of bulk sediment needed for the testing (estimated 15 gallons [10 gallons for treatability and 5 gallons for geotechnical testing] of sediment and 20 gallons of water per composite sample). The volume of sediment and water required to execute the geotechnical and treatability testing will be confirmed by the geotechnical and treatability laboratory.
- Sediment testing on the composited samples will include:
  - Geotechnical testing for grain size, moisture content, organic content, Atterberg limits, and specific gravity.
  - Polymer and polymer aid testing of each of the eight composited samples will consist of testing various types of polymers; either cationic, anionic or non-ionic and polymer aids or inorganic coagulants. These polymers must be environmentally safe for discharge back into the Cuyahoga River. Because of this, potable water polymers are preferred for this application. Additionally, the lowest polymer dose range is preferred.
  - Each of the eight composited core samples will be treated with the recommended polymer and polymer aid, if necessary, and shall be subjected to Geotube® rapid dewater test (RDT).
  - Treatability evaluation samples (elutriate and effluent aqueous samples) will be analyzed by the subcontracted laboratory for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, select total metals, select dissolved metals, total suspended solids, pH and alkalinity.
  - Following the RDT testing, each of the eight composited samples will be treated with the recommended polymer and polymer aid, if necessary, and shall further be subjected the Geotube® Dewatering Test (GDT) for field-scale evaluation (replaces the former Hanging Bag Test).

#### 1.3.2.1 Bathymetric Survey

A ~~B~~bathymetric survey will be conducted by Seaworks Group to provide baseline conditions of the sediment surface and the results will be compared to the interpolated bedrock surface developed in the

**Commented [GMB60]:** Same as sediment locations?
**Commented [AB61R60]:** Text revised to clarify
**Commented [GMB62]:** So the goal is to capture all sediment down to bedrock?
**Commented [AB63R62]:** This description is for probing. All the sediment is being removed so we'd want to see the complete sediment profile.
**Commented [SJ64R62]:** 10-7-19 call: Mary Beth and Julie discussed that the goal is not to get to bedrock; need to collect representative sediment to support Geotech data for design—need to add this clarification
**Commented [MG65]:** Will this cover the alternative dewatering method that Tom Leigh identified?
**Commented [AB66R65]:** Yes
**Commented [SJ67]:** We need to include specific details sub will be performing—see details in section above
**Commented [WD68R67]:** Details of the bathymetric survey are included in 2.2.1.1.
**Commented [SJ69R67]:** 10-7-19 call: Need to add reference to section 2.2.1.1.

~~previous phases of~~ investigation (Battelle 2012). Additional ~~bathymetry~~ details on the bathymetric survey are described in Section 2.2.1.1.

#### 1.3.2.2 River Bank Survey

A LIDAR aerial survey will be conducted by GPD to provide a topographic survey of the river banks that will be incorporated into the bathymetric survey- to provide a continuous survey from the sediment surface to the water's edge onto land.

### 1.3.3 Dredge Material Transport Pipeline and Laydown Area

A topographic survey will be conducted by GPD along the Highbridge Trial and Peck Road, from Front Street, to the Chuckery Area using land surveying and/or LIDAR aerial techniques~~, as determined by the subcontractor~~. The specific ~~T~~techniques used will be at the discretion of the surveyor. -Based on the September 25, 2019 site reconnaissance activities and debriefings (CH2M and EPA); coordination with Summit County Metro Parks is required to determine how the dredge material transport pipeline is best to enter the disposal area. ~~Two potential alignments have been identified with one running —around the east (along Peck Road, requiring road crossing) and the second is along path closest to the Cuyahoga River on the or west (along path closest to the Cuyahoga river) sides of the Chuckery Area parking lots.; therefore b~~Both ~~alignments options will be surveyed to conduct a comparison. The proposed dredged material transport pipeline is shown around the east (along Peck Road.) in Figure 1.~~

A topographic survey will also be conducted at the proposed Laydown area southeast of the Front St.reet bridge over the Cuyahoga River using land surveying and/or LIDAR aerial techniques. Techniques used will be at the discretion of surveyor. The proposed Laydown are is shown in Figure 1. ~~The proposed laydown area will also be the staging location fo crane the sediment sampling vessel into the river.~~

~~Per site recon, the Chuckery Race was identified along southern boundary at the proposed laydown area. The location of the Chuckery Race will be brought to the attention of the subcontractor, Aqua Survey, and precautions to protect this cultural resource will be organized.~~

### ~~1.3.3~~1.3.4 Disposal Area Investigation

- The investigation of the Chuckery ~~Disposal~~ Area will include a topographic survey and geotechnical sampling activities to address identified data gaps relative to subsurface conditions. Specifically, the objective of the field sampling and geotechnical testing is to obtain data to support foundation, settlement, and existing material reuse evaluations in the design. The disposal area geotechnical investigation activities will include:

- Utility locate services performed by GPRS, will include~~,~~ coordinating with the city and Summit County Metro Parks, Ohio Utility Protection Service (OUPS) call and third-party services. Third-party services will clear underground utilities at a 30-foot radius around each boring location using ~~with~~ ground penetrating radar.
- Conduct standard penetration test (SPT) borings at eight locations using a track-mounted hollow-stem auger drill rig. At each SPT boring, split-spoon samples will be collected at 2.5-foot intervals to 20 feet below ground surface (bgs) and at 5-foot intervals from 20 to 50 feet bgs~~on bedrock.~~ . If refusal is confirmed at depths shallower than 50 feet bgs, the boring will be terminated.- Boring logs will be prepared to document the visual characteristics observed such soil type, particle size, color, moisture and consistency. Samples from each 2.5-foot interval of the boring will be collected for

**Commented [GMB70]:** Are you conducting a topographic survey of the whole Chuckery area or a portion of it? If yes, then please include description of activities in this subsection.

**Commented [WD71R70]:** Revised text, last bullet.

**Commented [SJ72]:** Mary Beth email comment: There is no mention of the utility-locate subcontractor and their responsibilities or the need to crane the sampling vessel into the river.

**Commented [WD73R72]:** Revised text to include utility locate

**Commented [SJ74R72]:** 10-7-19 call: it was discussed that utility locate sub will not be listed in org chart.

**Commented [SJ75]:** Tony Demasi/CofCF: wants to add " or until boring refusal on bedrock"

**Commented [SJ76R75]:** Text revised to document that confirmation of bedrock at depths greater than 50 ft is not the goal of the drilling.

possible geotechnical laboratory analyses. Sample selection and testing assignment will be established following completion of the investigation and review of the boring logs by the geotechnical engineer prior to demobilization from the site. The selected samples will be analyzed for moisture content, Atterberg limits, grain size analysis (sieve and hydrometer), specific gravity, organic content, dry unit weight, compaction, permeability, one-dimensional consolidation, and triaxial compression strength tests.

- Following completion of the SPT borings, the lithological units will be identified by CH2M field team member to collect an undisturbed sample. This will be accomplished by drilling a co-located boring with SPT boring to the targeted depths. These undisturbed samples ~~In addition,~~ will~~additional~~ be collected using Shelby tubes and analyzed for consolidated undrained triaxial strength testing, hydraulic conductivity, and 1-dimensional consolidation.

- Install six piezometers for groundwater elevation measurement and baseline groundwater sampling. Groundwater elevations will be recorded monthly, for one year~~.~~ Baseline groundwater samples will be collected from the piezometers after well development and analyzed for polycyclic aromatic hydrocarbons (PAHs) and total metals—cadmium and lead. These parameters were selected because they exceeded their respective PEC values in ~~>~~greater than 50 percent~~%~~ of the samples, per ~~conclusion of~~ the Phase I and II Studies (Battelie, 2012).~~.~~

- Conduct cone penetration test (CPT) soundings at three locations includ~~ing~~es continuous data logging ~~with~~ and additional ~~data~~ pore pressure dissipation tests collected at 3-meter intervals ~~to depths of 50 feet bgs~~. -Soundings will be advance to 50 feet bgs. If refusal is confirmed at depths shallower than 50 feet bgs, the boring will be terminated. ~~, or until sounding refusalonbedrock~~ . ~~, and one dilatometer test per sounding.~~ After collecting CPT and pore pressure data, instrumentation will be changed to conduct ~~collect~~ one dilatometer test per boring, at a depth based on site conditions, to target settlement prone soils.

As a result of the site reconnaissance the following elements were considered when developing site access in Chuckery Area:

- A shallow (mounded above grade) sewer line parallels the north side of Peck Road and crosses to the south side about 900 feet before the Indian Signal Tree parking lot; a sewer line crosses the disposal site—loading and access conditions require further coordination; a sewer line approaches the southernmost corner of the disposal area—it is preferred not to build over this sewer line by relocating disposal site boundary's as necessary. The positioning of the disposal area with respect to existing utilities (sewers), will require future coordination between EPA, City of Akron and Summit Metro Parks as part of the RD.

- Delineated wetlands exist within the proposed disposal area—primarily along the northern boundary. Although the disposal site does not interfere with the existing surface water drainage way and culvert crossing the Chuckery Trail, proposed locations SPT-3 and SPT-8 and CPT-C were within wetlands and have been relocated, see revised Figure 4. The positioning of the disposal area with respect to the wetlands, cultural resources, and existing utilities (sewers), will require future discussion and coordination as part of the RD.

- Per site reconnaissance and coordination with the city of Akron, loading conditions warrant restricted passage over existing sewers and third-party location services will locate the existing sewers.

A topographic survey will be conducted at the Chuckery Area to provide baseline conditions using land surveying and/or LIDAR aerial techniques. -Techniques used will be at the discretion of the surveyor. The topographic survey of the Chuckery Area is bounded by the Indian Signal tree parking lot, Cuyahoga

**Commented [GMB77]:** Please fix sentence and describe why you need to use Shelby tubes and what the additional material is being collected for.

**Commented [SJ78R77]:** Text revised

**Commented [GMB79]:** Include an explanation as to why these are the only parameters to be analyzed.

**Commented [WD80R79]:** Revised text. See pg. 73 of battelle report

**Commented [GMB81]:** For how long?

**Commented [WD82R81]:** Revised Text

**Commented [GMB83]:** Is this supposed to say "additional pore pressure dissipation tests…"? Not sure if "data" is necessary in this sentence or if this sounds confusing to me just because I am not familiar with this test.

**Commented [WD84R83]:** Revised text

**Commented [SJ85]:** Tony Demasi/CofCF: wants to add " or until boring refusal on bedrock"

**Commented [WD86R85]:** Revised text

**Commented [SJ87]:** Tony Demasi/CofCF: wants to add " or until boring refusal on bedrock"

**Commented [RM88]:** Mary Beth is taking the lead on getting guidance on this. Once we know what is required, we should state that in the SAP.

**Commented [SJ89R88]:** 10-7-19 call: Mary Beth will provide update once we know what is required

**Commented [SJ90R88]:** Per EPA call on 10-9-19, can't drive over sewers

~~r~~River, Peck Road and Cuyahoga Street. The baseline survey will be used to generate the disposal site's existing condition, which will be used to generate subgrade and liner elevations. In addition, the completed SPT, CPT, and piezometer locations will be surveyed in during the topographic survey.

### ~~1.3.4~~1.3.5 Project Schedule

Commented [GMB91]: What is expected laboratory turnaround time for the various tests and analyses?

Commented [WD92R91]: Revised text

The investigation activities at the Chuckery ~~Disposal~~ Area and the Cuyahoga River Dam pool are anticipated to begin in ~~October~~ November 2019 following EPA approval of the final SAP. The field activities are anticipated to take up to 30 calendar days.

The draft data summary report will be submitted 1 month after receipt and validation of all laboratory data. CH2M anticipates a maximum turnaround time of 21-days for the analytical results~~samples~~. The draft field site sampling technical memorandum will be submitted 2 weeks after completion of data validation, followed by a final version 10 days after receiving comments from EPA. The treatability laboratory will complete their study and provide a technical memorandum 4 weeks after receipt of samples for review and evaluation by CH2M. The GLSED deliverables will be submitted 1 month after receipt of the third-party data validation report.

## 1.4 Data Quality Objectives and Criteria for Measurement Data

DQOs are qualitative and quantitative statements that define the objectives of the project. The DQOs are used to determine the most appropriate type of data, determine the appropriate procedures for data collection, and specify acceptable decision error limits that establish the quantity and quality of data needed for decision making. The technical planning team developed project-specific DQOs in accordance with *Guidance on Systematic Planning Using the Data Quality Objectives Process* (EPA, 2006). The results of the seven-step DQO process for the Gorge Dam project are presented in Table 2~~1~~.

## 1.5 Instructions for Special Training Requirements and Certification

The personnel engaged in field activities will have completed the U.S. Occupational Safety and Health Administration 40-hour health and safety training that meets the requirements of 29 Code of Federal Regulations 1910.120. Subcontracted project personnel will read the project-specific HASP, and documentation will be maintained to demonstrate that the requirements of the plan are followed. General topics covered in the HASP include site location and scope of work, safety and health risk analysis, field team organization and responsibilities, personal protective equipment (PPE), site control measures, decontamination procedures, emergency response plan, employee training, and medical monitoring. Site-specific tasks, such as sediment sampling near the Dam structure, will require specific work plans that will be included in the subcontractor's site-specific HASP, which will be reviewed by CH2M prior to starting the work. The HASP will be kept onsite during field activities, and a copy will be maintained in the project files.

Commented [GMB93]: Of particular concern is the location of the farthest downstream sampling site in relation to the dam. HASP must address that and maybe the vibracoring contractor needs to provide info on how they will take the necessary precautions.

Commented [AB94R93]: The CH2M project-specific HASP will include a requirement for the Subcontractor to provide a method for review their proposed sampling methods near the dam and mitigation measure to prevent the sampling vessel from getting too near the dam structure.
The Subcontractor's work plan must also include a description of mitigation measure to prevent the sampling vessel from getting too near the dam structure.

Commented [WD95R93]: The CH2M HASP has been updated to read, "The subcontractor's site specific HASP must include a work plan for boating and sediment sampling activities adjacent to the Dam structure."

Laboratories participating in analytical services will be certified as required by applicable state and/or federal agencies for the fields of testing relevant to the requirements for the project. The laboratory must have current National Environmental Laboratory Accreditation Conference certification for all of the certifiable methods performed as part of the investigation. The laboratory managers will be responsible for ensuring that all personnel have been properly trained and are qualified to perform their assigned tasks.

# 1.6 Instructions for Documentation and Records

## 1.6.1 Field Sampling Documentation

Field sampling activities will be recorded in field logbooks as specified in field operating procedures (FOPs) provided in Appendix B. Logbook entries will provide as much detail as possible so that personnel going to the site can reconstruct a particular situation without reliance on memory. Modifications to field sampling protocols must be documented in the field logbook. The field team leader is responsible for verifying that modifications to sampling protocols have been documented.

Field logbooks will be bound field survey books or notebooks. Logbooks will be assigned to the field crew but stored in a secure location when not in use. The project name will identify each logbook, the title page of which will contain the following information:

- The name of the person to whom the logbook is assigned
- Logbook number
- Project name
- Project start date
- Project end date

At the beginning of each entry, the date, start time, weather, names of all sampling team members present, and the signature of the person making the entry will be documented. Measurements and samples collected will be recorded with a detailed description of the location of the station. The number of photographs taken also will be noted. Equipment used to make measurements will be identified, along with the date of calibration.

Entries will be made in indelible ink, and no erasures will be allowed. If an incorrect entry is made, the information will be crossed out with a single strike mark, initialed, and dated. Blank pages will be noted as being intentionally blank.

Samples will be collected following the sampling procedures documented in the FOPs provided in Appendix B. Sample collection equipment will be identified, along with the time of sampling, sample description, parameters being analyzed, and number of containers. Unique sample identification will be assigned to each sample, including field duplicate samples, and will be noted in the field logbook or field forms.

Field personnel will provide comprehensive documentation of the various aspects of field sampling, field analysis, and sample chain of custody. This documentation constitutes a record that allows reconstruction of the field events to aid in the data review and interpretation process. Documents, records, and information relating to the performance of the fieldwork will be retained in the project file.

## 1.6.2 Data Reporting

Analytical data will be submitted in accordance with the laboratory contract. A data usability report will be completed and submitted as part of the project data deliverables by the project chemist. The report will include a review of the merged field and laboratory data, an assessment of field sample precision, a statement about data set completeness, and an assessment of overall usability that explains concerns about data usability for the intended purpose. Limitations of the data usability and deviations from the SAP will also be evaluated and reported.

### 1.6.2.1 Field Data Reporting

Information collected in the field through visual observation, manual measurement, or field instrumentation will be recorded in field notebooks or forms and then entered into an electronic data file (Scribe database) after the completion of the field event or stored electronically (in portable document format, or PDF) in the project file. The field team leader or project chemist will review the data for adherence to this SAP and for consistency. Concerns identified as a result of the review will be discussed with the CH2M project manager and the CH2M QAM, corrected if possible, and incorporated into the data evaluation process.

Field data calculations, transfers, and interpretations will be conducted by the field team and reviewed for accuracy by the field team leader, project chemist, or appropriate designee. The appropriate task manager will review field documentation, data reduction, and accuracy of data entries into the data log. The data logs and documents will be checked for the following:

- General completeness
- Readability
- Use of appropriate procedures
- Clearly stated modifications to sampling procedures
- Appropriate instrument calibration and maintenance records
- Reasonableness of data collected
- Correctness of sample locations
- Correctness of reporting units, calculations, and interpretations

Where appropriate, field data forms and calculations will be processed and included in appendixes to the report. Original field logs, documents, and data reductions will be kept in the project file.

Standard forms, such as field core logs (see Appendix B, FOP-05 Logging of Soil Borings), will be used in addition to the field logbooks to ensure that necessary data are recorded consistently and provide a more detailed record. No blank spaces will appear on completed forms. If information requested is not applicable, the space will be marked with a dashed line or marked "N/A." The forms are to be completed in the field and placed in the project files.

**Commented [SJ96]:** Suggest the reference be expanded to include the specific SOP containing the soil boring log forms (e.g., Appendix B, FOP-05).

**Commented [WD97R96]:** Revised Text

### 1.6.2.2 Laboratory Data Reporting

Whenever possible, analytical data will be transferred directly from the instrument to a computerized data system. Raw data will be stored electronically. Laboratory data entry will be sufficient to document information used to arrive at reported values.

Electronic data storage will be used when possible. The electronic data will be maintained in a manner that prevents inadvertent loss, corruption, and inappropriate alteration. Electronic data will be accessible and retrievable for a period of 365 days after final acceptance of data.

Deviations from stated guidelines must be addressed through corrective action. Deviations caused by factors outside the laboratory's control, such as matrix interference, will be noted with an explanation in the report narrative. The laboratory will contact the project chemist to discuss deviations before the final data are submitted. Calculations will be checked, and reports reviewed for errors, oversights, or omissions. The hard copy and electronic laboratory reports for samples and analyses will contain the information necessary to perform data evaluation. The subcontract laboratory will follow the appropriate reporting requirements as written in the laboratory SOW and associated subcontract. The results for geotechnical parameters will be verified by the laboratory and will be reviewed for completeness and usability by CH2M. Geotechnical results will not undergo data verification or validation.

#### 1.6.2.3 Project Document Control

CH2M is responsible for the content, distribution, and version control of the site plan documents, including this SAP. Specifically, the project manager is responsible for implementing proper version control maintenance standards for the site plans. A memorandum will accompany site plan updates and revisions, instructing the project team to discard old versions of the plan. Current and archived site plans will be stored in the project files in the CH2M office in Milwaukee, Wisconsin and their respective project local area network hard drive. Project records will be stored and maintained in accordance with CH2M's data management plan, discussed in Section 2.9.

The distribution list for this SAP is provided on page v.

### 1.6.3 Electronic Analytical Record Format

The field-collected data and analytical sample information will be entered into the Scribe database by the CH2M Sample Manager, Jaime Engle, in accordance with the *Great Lakes Legacy Act Data Reporting Standard* (EPA, 2010). The CH2M Sample Manager will enter sample management data daily during the field event into Scribe and the field data will be entered into Scribe at the conclusion of the sampling event.

The subcontract laboratory will report the analytical data to CH2M in the EPA Region 5 Environmental Quality Information System (EQuIS) EDD 6.6 format for all methods.

CH2M will provide the complete project EDD to GLNPO for entry into EPA's GLSED. The EDD will include a complete set of field and laboratory data consistent with *Great Lakes Legacy Act Data Reporting Standards* (EPA, 2010) and a narrative that explains concerns about data usability for the intended purpose associated with laboratory or field data flags or anomalies.

Geotechnical data will be provided to the project team for review and verification in a format that the geotechnical subcontracted laboratory is capable of creating, such as a PDF report or general excel document.

### 1.6.4 Project Record Maintenance and Storage

Project records will be stored and maintained in accordance with CH2M's data management plan, discussed in Section 2.12~~9~~. Each project team member will be responsible for filing project information or providing it to the project assistant familiar with the project filing system. Individual team members may maintain separate files or notebooks for individual tasks but must provide such materials to the project manager upon completion of each task.

The following are the general project file categories:

- Correspondence
- Original reports
- Nonlaboratory project invoices and approvals by vendor
- Nonlaboratory requests for proposals, bids, contracts, and SOWs
- Field data
- Data evaluation and calculations
- Site reports from others
- Photographs
- Laboratory analytical data and associated documents and memos
- Regulatory submittals, licensing, and permitting applications
- Site and reference material

- HASP
- Figures and drawings

A project-specific index of file contents is kept with the project files at all times. The project record file will be transferred to EPA as part of the closeout activities.

# Data Generation and Acquisition

Section 2 describes the procedures for acquiring, collecting, handling, measuring, and managing data in support of this sampling activity. It addresses the following data generation and acquisition aspects:

- Sampling process design
- Sampling method requirements
- Sample handling and custody requirements
- Laboratory analytical method requirements
- Laboratory QC requirements
- Field and laboratory instrument calibration and frequency
- Field and laboratory instrument and equipment testing, inspection, and maintenance requirements
- Inspection and acceptance requirements for supplies and consumables
- Data acquisition requirements
- Data management

## 2.1 Sampling Process Design

CH2M performed a data gap evaluation (CH2M, 2019) for the RD using data included in the 2012 remedial investigation Phases 1 and 2 report (Battelle, 2012) and information presented in the feasibility study (Tetra Tech, 2015). Documents including ~~varying from~~ historical blueprints, case studies, Dam related studies, and guidebooks to public presentations were also reviewed, the list of referenced background documents can be found in the data gaps evaluation. The findings from this remedial design data gap evaluation are the focus of this SAP with the DQOs presented in Table 2~~1.~~

Commented [GMB98]: Should we also mention data/info received from the project team?

Commented [WD99R98]: Text Revised

### 2.1.1 Field Investigation Approach

This section presents the sediment and disposal area sampling activity details and incorporates the information gathered during the ~~. These have been revised based on a~~ site reconnaissance performed on September 25, 2019~~ to discuss field access for sampling activities. Reference to information discussed during this site visit is identified in this SAP.~~

The CH2M field team leader and field team with support from CH2M's subcontractors are responsible for the following activities:

- Mobilization and demobilization activities, including efforts related to obtaining equipment and bringing it to the site, preparing the investigation-derived waste (IDW) staging and sample processing areas, as well as setting up equipment and sampling supplies. Demobilization activities include equipment return, ~~and~~ general site shutdown, and per site ~~recon~~reconnaissance—restoring disturbed areas visible from the trail and within 20 feet of the trail/access roads~~.~~
- Documenting field measurement data, including water elevation, water depth, penetration depth, and recovery measurements of each of the sediment locations.
- Collecting and documenting positional data (latitude and longitude coordinates) and elevation for each sample location.
- Collecting sediment/soil cores, logging stratigraphy and visual observations, processing samples, and collecting photographic documentation of field activities and cores during processing. Samples for

Commented [GMB100]: And restoration, if necessary, to bring back to original condition.

Commented [WD101R100]: Revised with Chucks summary point

Commented [SJ102R100]: 10-7-19 call: Mary Beth is discussing this the Summit Metro Park. They may do the restoration themselves. Include the outcome of that discussion and decisions in the SAP. She's waiting to hear from Chuck Hauber/SMP.

chemical and physical laboratory analyses will be processed and shipped under proper chain-of-custody to the designated subcontract laboratory.

- Conducting SPT drilling, CPT soundings, and installing piezometers in the disposal area and collecting water level measurements and baseline groundwater samples.
- Collecting soil samples for geotechnical testing.
- Perform bathymetric and topographic surveys.

### 2.1.2 Field Collection Methods

The procedures for collecting the data are presented in the following FOPs and are included in Appendix B. In the instances where a FOP is not referenced in Appendix B, the text of the SAP section will act as the operating procedure for that task.

| FOP Number | Title |
|---|---|
| FOP-01 | Sediment Sampling Vessel Operation and Station Positioning |
| FOP-02 | Global Positioning System Procedures |
| FOP-03 | Vibracore~~Direct-push Technology Drilling and~~ Sediment Sampl~~e~~ing Collection |
| FOP-04 | Geotechnical Field Testing |
| FOP-05 | Logging Soil Borings |
| FOP-06 | Monitoring Well Development |
| FOP-07 | Sample Handling, Packaging, and Shipping |
| FOP-08 | Field Equipment Cleaning and Decontamination Procedures |
| FOP-09 | Decontamination of Drilling Rigs and Equipment |
| FOP-10 | Documentation and Chain-of-Custody Procedure |
| FOP-11 | Field Logbook |
| FOP-12 | Monitoring Well Sampling |
| ASTM D5778-12 | Standard Test Method for Electronic Friction Cone and Piezocone Penetration Testing of Soils |
| ASTM D6635 | Standard Test Method for Performing the Flat Plate Dilatometer |

## 2.2 Sampling Activities and Procedures

Commented [GMB103]: Add a section for topographic surveying along the High Bridge trail and other areas.

Commented [SJ104R103]: Added a section for Bathy

### 2.2.1 Sediment Sampling

Descriptions of the activities and procedures associated with the ~~conducting~~ sediment sampling activities are described in the following subsections. The general sediment ~~; however, a summary overview of the~~ sampling activities ~~e collection~~ will include~~s the following activities:~~. ~~The proposed investigation sample locations are shown on Figure 3. A summary of each proposed sample location's x, y coordinates and respective sampling parameters and analytical analysis are presented in Table 2. A summary of sample containers, preservation, and holding times is presented in Table 3 prepared for this sampling event.~~

- Conducting bathymetric, side scan, and magnetometer surveys

Commented [SJ105]: 10-7-19 call: added to intro an overview of sediment activities to provide clarification.

- Positioning of sampling vessel within 10 feet of proposed ~~sample~~ location ~~using GPS of sub-meter accuracy~~
- ~~Record sample coordinates~~
- Conducting water depth and sediment probe thickness measurements~~Probe (rod with bottom plate) or sound top of sediment (surveyors' tape with weighted disk) top of sediment~~
- ~~Record water depths to 0.1 foot~~
- ~~Probe sediment column with surveyor's rod~~
- ~~Record sediment probing depth~~
- Collecting sediment cores using Vibracore technology to refusal or 20 feet (whichever occurs first) ~~Vibracore sediment sample~~
- Performing sediment core logging, ~~Log sediment core~~geotechnical field testing, and photographic documentation on cores retained for sampling
- Process retained cores into composite samples for geotechnical and coagulant/polymer treatability testing~~.~~

  - ~~Continue to collect half treatability sediment (5 gallon) and geotechnical (2.5 gallon) sample volumes; sediment samples are anticipated to be emptied into a mixing bucket, homogenized, and split into the buckets.~~
  - ~~Collect half of the treatability water volume (10 gallons) at mid depth in water column; water samples will be pumped from mid-depth directly into 5-gallon pails and composited by filling half full at each location~~
- ~~Reposition the vessel to the complimentary composite location, collect samples as above.; final sample will be the result of compositing these two locations~~

The proposed investigation sample locations are shown on Figure 3. A summary of each proposed sample location's *x*, *y* coordinates and respective sampling parameters and analytical analysis are presented in Table 3. A summary of sample containers, preservation, and holding times is presented in Table 4 ~~prepared for this sampling event~~.

### 2.2.1.1 Bathymetric Surveying

The bathymetric survey performed by Seaworks Group will include a mulit-beam bathymetric survey; side-scan sonar imaging; and a magnetometer survey.

The multi~~t~~-beam bathymetric survey will be conducted at 2-centimeter accuracy standards and be reported to the nearest 0.05 foot. The multi-beam bathymetric survey will provide the baseline conditions of the sediment surface. The data ~~is~~ will be merged with the bank survey (Section 2.2.2) and used to ~~for~~ calculate~~ing~~ the new sediment volume (with existing probing data for bottom elevations) and to reassess ~~. T~~the size of the disposal area that will be needed to contain the dredged material~~will be reassessed with the new sediment volume~~.

Side-scan sonar imaging will be conducted to identity river bed surface features such as structures, debris, and utilities as well as surface substrate type characteristics.

The magnetometer survey will be conducted to locate underwater metallic objects such as utilities and metallic debris.

#### ~~2.2.1.1~~2.2.1.2 Surveying of Sample Locations

~~To meet the goals of the sampling event, precise positioning of sediment coring locations is required. Both accuracy (that is, ability to define position) and repeatability (that is, ability to return to a sampling station) are essential. One sampling vessel will be used.~~ Positioning of the vessel and recording the horizontal position of sediment core locations will be accomplished with the use of Trimble differential global positioning system (dGPS) handheld receivers capable of submeter accuracy. ~~Recording of x,y coordinates and water depth will be performed by CH2M the subcontractor aboard the sampling vessel at each proposed sample location. Navigation of the submeter GPS equipment will be checked each morning and at the end of the day by recording the x,y coordinates at a benchmark or reference point established by the topography or bathymetric survey subcontractor. Navigation of the submeter GPS equipment will be checked each morning and at the end of the day by recording the x,y coordinates of the known benchmark.~~

Sampling locations will be referenced horizontally using easting and northing coordinates using the World Geodetic System 84 datum measured in U.S. survey feet. The as-sampled coordinates of each location will be recorded at the time of sampling with a sub-meter~~the~~ Trimble dGPS unit and noted within the field logbook. ~~The bathymetry will serve as the top of sediment elevation; therefore, no water elevations will be recorded at the time of sampling. or design purposes the top of sediment will serve as datum; the zero-depth of the core sample with coincide with this datum.~~

Water elevations during sampling activities will be surveyed using a data-logging staff gauge. The staff gauge will be installed and surveyed in prior to sampling and will collect water elevations at 15-minute intervals. Water depth measurements will be collected at each location for the determination of sediment elevations. Water depths less than 25-feet will be measured to the nearest 0.1 foot using a surveyor's rod outfitted with a 6-inch-diameter plate or a surveyor's tape outfitted with a sounding disc or bell anchor 6 inches in diameter and weighing between 7 and 8 pounds per the United States Army Corp of Engineers (USACE) guidance document (USACE, 2013). If the current is too strong or water depth is greater than 25 feet, a depth sounder will be used. Following water depth measurement collections, ~~S~~sediment probing will be conducted by manually advancing a ¾-inch-outer-diameter steel rod under the weight of the technician until refusal in order estimate depth to bedrock and to gauge sediment thickness for approximate determination of ~~approximate~~ the anticipated ~~core~~vibracore penetration depth~~boring depth~~. During probe advancement and at refusal, sediment type (i.e., silt, sand, bedrock, etc.) observations telegraphed through the sediment probe will be noted ~~and used to determine the type of substrate encountered~~. Additionally, refusal depths will be compared to boring logs collected during the previous investigation~~.~~ and assessed for ~~comparable~~ depth to bedrock ~~measurements~~.

~~At refusal, t~~The total probe advancement~~penetration~~ depth will be measured to the water surface and~~.~~ ~~T~~the water depth measurement will be subtracted from the probe ~~penetration refusal~~ depth to calculate sediment thickness. Water and sediment probe depths will be documented within the field logbook.

Procedures for the differential GPS requirements and positioning of sampling vessels are documented within CH2M FOP-01, *Sediment Sampling Vessel Operation and Station Positioning,* and FOP-02, *Global Positioning System Procedures* (Appendix B).

**Commented [GMB106]:** Not by the subcontractor?

**Commented [WD107R106]:** Text Revised

**Commented [GMB108]:** Can this be identified on the figure?

**Commented [RH109R108]:** No – not established yet. Updated text.

**Commented [GMB110]:** Can this be identified on the figure?

**Commented [WD111R110]:** Text revised.

**Commented [GMB112]:** Need to expand on this.

**Commented [WD113R112]:** Revised Text (Water depths are not required in the SOW)

**Commented [AB114R112]:** Deleted. We are going to use staff gauge to determine water surface elevation.

In addition, a topographic survey will be conducted, by GPD, at the proposed dredge pipeline routes and laydown area shown in Figure 2 to provide baseline conditions using land surveying techniques. The baseline conditions will be surveyed at an accuracy and density to develop 1-foot contour mapping.

#### ~~2.2.1.2~~2.2.1.3 Sediment Sampling

Sediment cores will be collected by CH2M's subcontractor, Aqua Survey, using a vessel outfitted with vibracore equipment ~~used during the previous investigation, however, Aqua Survey's equipment is~~ limited to a maximum core length of 20 feet. ~~Macro-Core samplers to expedite the work.~~ The ~~actual vessel size will be determined by the Subcontractor; however, the vessel is expected to consist of a 30- by 90-foot spud barge~~vessel will be capable of working in water depths of 4 to 40 feet ~~to target areas of deeper water.~~ ~~Locations near shore and in shallow water (less than 15 feet) will be manually probed prior to sampling to determine if riprap or other debris is present prior to performing a sampling attempt. Sediment probing depths, x,y coordinates, and general notes on sediment type encountered will be documented within the field logbook.~~

~~Sediment cores will be collected continuously in 4-foot sections down to bedrock using a sampling rig and device determined by the Subcontractor. Previous investigations collected samples using vibracore technology; however, selection of the type of sediment sampling equipment shall be determined by the subcontractor. A Macro-Core MC7 3-inch-diameter direct-push technology (DPT) sampler will be implemented in order to collect sufficient sample volume at each interval.~~

In order to increase sediment recovery, each polycarbonate core~~the DPT Macro-Core acetate~~ liner will be equipped with a sediment retainer or a device designed to maximize sediment core recovery. If three attempts result in core recovery of less than 75~~50~~ percent the core penetration, the core with the greatest recovery will be used for sample processing. If no sediment can be recovered after the third attempt, the CH2M field team leader or designee will contact the CH2M project manager and the GLNPO COTR~~task order contracting representative~~ for further instruction to relocate a sample location.

Upon sediment core retrieval, the core may be sectioned into manageable lengths, then sealed at bottom and top ~~will be capped then sealed with duct or electrician's tape~~ and labeled with location and interval information. Residual sediments on the outside of the core will be returned to the waterbody at the time of sample collection for each location. Cores will be kept in an upright position on the vessel until being processed. Sediment core logging and processing will be performed by CH2M as described in Section 2.2.1.5. Measurements and field notes will be recorded as described in Section 5.2. Procedures for sediment sampling collection are documented within CH2M FOP-03, Vibracore~~Direct-push Technology Drilling and~~ Sediment Sampling Collection (Appendix B).

#### 2.2.1.4 Sediment Processing

Sediment cores collected will be processed on the vessel by CH2M staff. Before processing, the top core cap will be removed, and remaining free water at the surface interval will be decanted by slowly tipping the core at the minimum angle needed, with care given not to pour out fine-grained sediments at the sediment/water interface. ~~The sediment core will then be processed and segmented into the appropriate sample intervals for analysis.~~

Each sediment core will be cut open lengthwise while in a horizontal position and visually characterized for textural class, color, moisture content, particle size and shape, consistency, and other observations (for example, staining and odor). Digital photographs will be taken of each sediment core ~~before it is segmented into samples~~ to document the undisturbed sediment structure. Each photograph will include a scale (tape measure), station identification (ID), depth interval being represented, and date of core collection.

**Commented [GMB115]:** How do you know for sure you are getting all the way to bedrock?

**Commented [AB116R115]:** Any sediment sampling devise (vibracore or auger) will not penetrate into the bedrock. Based on previous bore logs the field team should have an idea of the elevation of the bedrock and if refusal is encountered, the field team will know if it is a rock or other obstruction or bedrock.

**Commented [SJ117]:** Mark Loomis: Providing all information missing from this draft, including identification of subcontractors and analytical laboratories that are currently identified as "TBD", and adding the analytical laboratory Standard Operating Procedures (SOPs) to Appendix A;

**Commented [AB118R117]:** Added text

**Commented [GMB119]:** Multiple samplers?

**Commented [AB120R119]:** No, a single sampler

**Commented [GMB121]:** Which is it? Contractor selecting equipment or have to use Macro-Core MC7 3-in diameter DPT sampler?

**Commented [AB122R121]:** Subcontract will use vibracore

Geotechnical field parameters for each core will be collected using a pocket penetrometer and shear torvane. A bulk density field test will also be conducted by weighing the sediment core and dividing by the core tube volume to compute the core bulk density.

#### ~~2.2.1.3~~2.2.1.5 Composite Sediment and River Water Sampling

Sediment from the 16 locations will be field composited as part of processing activities into 8 samples (2 locations~~borings~~ per composite) to form 10 gallons of homogenized sediment per sample for~~to~~ ~~conduct geotechnical and~~ coagulant/polymer treatability testing (Figure 3). Composite samples will consist of coupled locations 1 and &2, 3 and &4, through 15 and &16. Ten ~~Residual sediments on the outside of the core will be returned to the waterbody at the time of sample collection for each location. The bulk sediment material will be collected using the Macro-Core MC7 3-inch-diameter DPT sampler to collect a minimum of volume of sediment determined by the geotechnical and treatability testing laboratories representing the entire soft sediment profile at the two of the boring locations. The appropriate volume (10 gallons) will be obtained by collecting multiple cores at the respective sample location, if needed. Additionally, eEach treatability sample bucket will be filled to the top with river water from each sediment sample location. An additional~~ 20 gallons of river water (~~four~~two, 5-gallon buckets ~~(20 gallons total)~~) ~~of river water~~ will ~~also~~ be collected for treatability testing purposes from ~~8~~ each of the 16 sample locations, resulting in a total of 160 gallons of river water.

#### ~~2.2.1.4~~2.2.1.6 Sediment Geotechnical Samples

Geotechnical testing will be conducted on each of the 8 composited sediment samples-. The volume of sediment required to execute the geotechnical testing is 5 gallons of sediment per composite sample. ~~It is Aqua Survey's, the subcontractor,'s responsibility to provide the geotechnical laboratory withil adequate sample volume for geotechnical testing.~~

~~The samples for laboratory testing will be determined by the CH2M field team memberrepresentative at the time of sampling.~~ Geotechnical samples will be relinquished from CH2M to the sediment collection subcontractor, Aqua Survey, at the end of the event for submission to the geotechnical lab. The subcontractor is responsible for preparation, handling and shipping of geotechnical samples, in accordance with FOP-07, Sample Handling, Packaging, and Shipping. CH2M will review the geotechnical lab results for completeness and usability.

### 2.2.2 Disposal Area Investigation

Descriptions of the activities and procedures associated with the disposal area investigation are described in the following subsections. The proposed ~~investigation~~ sample locations are shown on Figure 4 and approximate coordinates are presented in Table 2. Sampling locations will be field-confirmed~~determined in the field~~ by CH2M based on accessibility and field conditions. The actual sampling locations ~~and~~ will be topographically surveyed ~~in place~~ after sampling is complete. A summary of geotechnical analyses is summarized in Table 54. A summary of sample containers, preservation, and holding times is presented in Table 43.

#### 2.2.2.1 Topographic Survey

A topographic survey will be conducted, by GPD, at the Chuckery Area to provide baseline conditions using land surveying and/or LIDAR aerial techniques. Techniques used will be at the discretion of the surveyor. The topographic survey of the Chuckery Area is bounded by the Indian Signal tree parking lot, Cuyahoga river, Peck Road and Cuyahoga Street. The baseline conditions will be surveyed at an accuracy and density to develop for 1-foot contour mapping. It is anticipated that standard land topographic surveying techniques will be used in the Chuckery area based on site conditions observed ~~witnessed~~ during the site ~~recon~~reconnaissance.

**Commented [SJ123]:** Table 2, Figure 3 – Table 2 (Sample Locations and Parameters Summary) provides Location ID Numbers for the 16 proposed Gorge Dam sampling locations; however, Figure 3 (Sediment Sampling Locations) does not include the Location ID Numbers alongside the sampling locations, which are currently identified only by yellow circles. These sample locations in Figure 3 should be labeled with the Sample Location IDs to match up with those listed in Table 2.

**Commented [SJ124R123]:** Tables updated

**Commented [SJ125]:** Section 2.2.1.4 – The second paragraph in Section 2.2.1.4 (Sediment Geotechnical Samples) states, "The samples for laboratory testing will be determined by the CH2M field representative at the time of sampling. Geotechnical samples will be relinquished from CH2M to the subcontractor at the end of the event for submission to the geotechnical lab." The title CH2M Field Representative in Section 2.2.1.4 is the first use of this title. Is this the CH2M Field Team Leader or the CH2M Field Team Member? Also, is the subcontractor Mateco the geotechnical sampling and laboratory subcontractor? Please clarify.

**Commented [SJ126R125]:**

**Commented [AB127R125]:** Added text

**Commented [WD128R127]:** The sediment sampling contractor, Aqua Survey, is responsible for performing the sediment geotechnical laboratory analyses.

All sediment samples, grab samples from the composite of two coring locations, collected for geotechnical analyses will be submitted to the sediment contractor, Aqua Survey, for geotechnical analyses.

**Commented [MG129]:** What's the basis for selecting samples?

**Commented [AB130R129]:** All eight composited samples will have geotechnical testing performed on them as well as treatability testing. Text deleted.

**Commented [SJ131]:** Section 2.2.2 — The third sentence in Section 2.2.2 (Disposal Area Investigation) states, "Sampling locations will be determined in the field by CH2M based on accessibility and will be topographically surveyed in place after sampling is complete. A summary of geotechnical analyses is summarized in Table 4." While the sentence indicates that that sampling locations will be determined in the field by CH2M based on accessibility, 11 proposed sampling locations for the disposal area are already shown on the Figure 4 Disposal Area Drilling Locations map. Are coordinates already known for these disposal area sampling locations? If so, a coordinate location table for the Disposal Area CPT and SPT locations similar to Table 2 should be prepared. Also, who will be performing the topographic surveys of the sampling locations? The topographic surveyor has not been yet identified.

**Commented [WD132R131]:** Table 2 has been updated with revised SPT/CPT and piezometer locations, per site recon activities.

GPD is topo sub

### ~~2.2.2.1~~2.2.2.2 SPT Drilling

SPT borings will be advanced by Mateco Drilling using a track-mounted drill rig at eight locations. SPT split-spoon samples will be collected at 2.5-foot depth intervals to 20 feet bgs and at 5-foot depth intervals thereafter to 50 feet bgs, or as directed by the CH2M field team member~~engineer~~. If bedrock refusal is confirmed at depths shallower than 50 feet bgs, the boring will be terminated. Samples will be collected in accordance with the *Standard Method for Penetration Test and Split-Barrel Sampling of Soils* (ASTM D1586). The split-spoon soil samples will be visually classified by the CH2M field team member~~field engineer~~, placed in new jars provided by the subcontractor, Mateco, and labeled and sealed for transport to a testing laboratory. Mateco~~The subcontractor~~ is responsible for transportation to the laboratory. The borings will be logged by a CH2M field team member~~engineer~~ according to FOP-05, Logging Soil Borings . CH2M will determine what samples will be selected for geotechnical testing after the ~~reviewing the boring logs~~borings and soundings are complete. Specific testing will be based on a wholistic review of the SPT boring logs and CPT data collected and geotechnical engineering judgement. The number of samples presented in Table ~~5~~4 are typical number of samples used to characterize subsurface conditions and to support the design of a disposal facility.

Shelby tube samples will be collected using direct push technology methods at locations and depths as directed by the CH2M field team member~~engineer~~. Shelby tube samples will be collected at locations/depths to sample soils representative of general conditions and to target isolated soils varying from general conditions. Shelby tube will be managed in general accordance with ASTM D 1587, Standard Practice for Thin Walled Tube Sampling of Soils. Undisturbed soil samples will be recovered in cohesive soils by hydraulically pushing a 3-inch diameter, thin-walled Shelby tube a distance of about 24 inches. The samples will be visually examined in the field from the bottom and the top of the tubes. Pocket penetrometer readings will be obtained on all fine-grained soil samples from the bottom of the tubes. Wax and sealed/taped rubber end caps shall be used to seal the tubes in the field soon after the visual examination. The undisturbed samples will be analyzed for their strength, settlement, and permeability characteristics.

Bulk auger cutting samples of surficial soils will be collected from three locations across the site, as determined by CH2M field team member~~engineer~~, to evaluate reuse as a potential fill material during disposal area construction. Potential reuse will be determined by the materials compaction, strength, and permeability characteristics.

Equipment will be cleaned with a pressure washer prior to mobilizing to the site, prior to installing piezometers, prior to demobilizing the site, and between geotechnical borings as directed by the CH2M field team member ~~engineer~~.

### ~~2.2.2.2~~2.2.2.3 CPT Soundings

CPT soundings will be advanced by In-Situ Soil Testing, L.C. using a track-mounted rig at three locations to 50 feet bgs. If bedrock refusal is confirmed at depths shallower than 50 feet bgs, the boring will be terminated. CPT soundings and pore pressure dissipation tests will be collected in accordance with ASTM D5778-12, *Standard Test Method for Electronic Friction Cone and Piezocone Penetration Testing of Soils.* Collection of cone resistance and frictional sleeve resistance measurements will be continuous over the 50-foot sounding. -Pore pressure dissipation tests will be collected at 3-meter intervals at each location. One dilatometer test, collected in accordance with ASTM D6635, *Standard Test Method for Performing the Flat Plate Dilatometer,* will be conducted at each of the three locations at a determined depth-based site conditions observed from SPT drilling and the evaluation of real time CPT data readouts. The depth ~~location~~ of the dilatometer test will be determined ~~considered~~ after reviewing other sampling and testing intervals to obtain a ~~spatial and~~ depth representive ~~ation~~ of subsurface conditions across the site.

**Commented [SJ133]:** Tony Demasi/CofCF: wants to add " or until boring refusal on bedrock"

**Commented [WD134R133]:** Text Revised

**Commented [SJ135]:** Mark Loomis: Section 2.2.2.1 – Section 2.2.2.1 (SPT Drilling) makes reference to the CH2M field engineer for the first time in the document. If this individual is to provide key project support, he/she should be identified in Section 1.1 and in Figure 1. In addition, the third sentence states, "The split-spoon soil samples will be visually classified by the CH2M field engineer, placed in new jars provided by the subcontractor, and labeled and sealed for transport to a testing laboratory." Is this testing laboratory the Mateco subcontractor and geotechnical testing laboratory? Please clarify.

**Commented [SJ136R135]:** Text revised

**Commented [MG137]:** What's the basis for selecting samples?

**Commented [WD138R137]:** Text revised

**Commented [SJ139]:** Section 2.2.2.1, Table 4 – The last sentence in the first paragraph in Section 2.2.2.1 (SPT Drilling) states, "The number of samples presented in Table 4 are typical number of samples used to characterize subsurface conditions and to support the design of a disposal facility." However, it's unclear how the numbers of proposed samples in Table 4 (Summary of Geotechnical Parameters and Sample Quantities for the Disposal Area) were determined (e.g., 131 samples for percent moisture, 32 samples for grain size, etc.). How many intervals are anticipated per core? Inclusion of additional detail on how the numbers of samples in Table 4 were derived would be beneficial.

**Commented [WD140R139]:** Comment addressed at similar comment at Table 4.

A 50-ft boring, 2.5 foot spacing to 20 ft and 5 foot spacing from 20 to 50 feet will yield 16 18-inch intervals.

**Commented [SJ141R139]:** Comment addressed in table 4

**Commented [SJ142]:** Sections 2.2.2.2, 2.2.2.3 – SAP Sections 2.2.2.2 (CPT Soundings) and 2.2.2.3 (Temporary Piezometers) describe the processes for CPT soundings and piezometer installations; however, the organizations, subcontractors, and/or individuals performing these functions are not identified.

**Commented [WD143R142]:** Text Revised

**Commented [SJ144]:** Tony Demasi/CofCF: wants to add " or until boring refusal on bedrock"

**Commented [WD145R144]:** Text revised

#### ~~2.2.2.3~~2.2.2.4 Temporary Piezometers

Piezometers will be installed by Mateco Drilling in a subset of six of the eight SPT geotechnical borings. The piezometers will be constructed with 1-inch-diameter PVC risers and screens, sand filter pack, bentonite seal, bentonite-cement grout, concrete pad, and locking standpipe surface completions. These will be installed with 10-foot-long screens set to an average of 15 feet bgs. These will be developed by surging and purging approximately five well volumes from each piezometer. The piezometers will be used to collect a single round of baseline groundwater samples and to measure groundwater elevations monthly for 1 year. Groundwater samples will be analyzed for PAHs and total metals—cadmium and lead. Temporary piezometers will be abandoned as part of disposal area construction activities. Procedures for the development and sampling of the piezometers will follow FOP-06, Monitoring Well Development, and FOP-12, Monitoring Well Sampling.

#### ~~2.2.2.4~~2.2.2.5 Borehole Abandonment

Following their drilling, Mateco Drilling will abandon the boreholes ~~will be abandoned~~ from bottom to top with a cement-bentonite grout mixture or bentonite pellets.

## 2.3 Field Equipment Decontamination

Nondisposable equipment used during sediment sampling or processing will be decontaminated prior to sampling activities and between samples in accordance with FOP-08, Field Equipment Cleaning and Decontamination Procedures. Disposable sampling equipment will be managed as described in Section 2.4.

Vessels will be checked to make them vegetation-free prior to launching and after demobilizing the vessel. Equipment used for the project, including sampling equipment and supplies, will be decontaminated for invasive and exotic viruses and species prior to and after use. To the extent practicable, the following steps will be taken every time the equipment is moved to and from the project site to avoid transporting invasive and exotic viruses and species:

- Inspect and remove aquatic plants, animals, and mud from equipment.
- Drain water from equipment that comes in contact with navigable waters, such as barges, boats, hoses, and pumps.
- Dispose of aquatic plants and animals in the trash. Never release or transfer aquatic plants, animals, or water from one waterbody to another.
- Wash equipment with hot water (greater than 104° Fahrenheit) or high-pressure water—*or* allow the equipment to dry thoroughly for 5 days before placing it in another body of water.

Drilling rigs and equipment will be decontaminated as described in FOP-09, Decontamination of Drilling Rigs and Equipment.

## 2.4 Investigation-derived Waste Management

CH2M will appropriately manage and segregate investigation-derived waste (IDW), including sediments, soil cuttings, purge water, liquid decontamination solutions, and disposable sampling items such as PPE and disposable sampling supplies generated from the field activities. IDW is proposed to be handled in the following manner:

- Excess sediment remaining after sample processing, will be treated as IDW, containerized in 5-gallon buckets at the processing area, and then transferred to a secure staging area for temporary storage in new placarded 55-gallon drums with secure lids.
- Excess soil cuttings from drilling operations and excess soil from sample processing will be treated as IDW, containerized in 5-gallon buckets at the processing area, and then transferred to a secure staging area for temporary storage in new placarded 55-gallon drums with secure lids.
- Liquid decontamination solutions generated on sampling vessels or at the sample processing location will be containerized in 5-gallon buckets and then transferred to a secure staging area for temporary storage in new placarded 55-gallon drums with secure lids.
- PPE and other disposable sampling materials such as polycarbonate core liners impacted by sediments will be rinsed to remove residual sediment and disposed of as general refuse.
- Other IDW such as plastic sheeting, disposable sampling materials, and PPE not impacted by soils/sediments or washed with a liquid decontamination solution to remove residual material will be disposed of as general refuse.

At the end of each day, IDW from the vessels and the soil sample processing area will be transferred to a secure staging area designated by CH2M for temporary storage. Liquid IDW will be stored within secondary containment. Each container for the storage or transfer of IDW will be labeled with the following information: media, source, date generated, and generator contact information (EPA). A composite sample will be collected from each type of drummed IDW waste (liquids and sediment) and analyzed for waste characterization parameters to assist in characterizing the IDW, obtaining a Resource Conservation and Recovery Act (RCRA) generator ID number (if necessary), and manifesting (if necessary) the material for disposal at an appropriate disposal facility. One sediment and one water sample will be collected for waste characterization per the analysis included in Table 6~~5~~. EPA will be considered the generator of any waste material, and the GLNPO task order contracting representative or appointed GLNPO designee will be required to sign waste manifests or other disposal paperwork if they are necessary.

## 2.5 Sample Handling and Custody Requirements

Accurate records and control of samples, including their controlled custody, are necessary to provide relevant and defensible data. The chain of custody is addressed during field sample collection, data analyses in the laboratory, and through proper handling of project files. Persons will be considered to have custody of samples when samples are in their physical possession, in their view after being in their possession, or in their physical possession and secured to prevent tampering. When samples are secured in a restricted area accessible only to authorized personnel, they will be deemed to be in the custody of such personnel.

Chain-of-custody forms will provide the record of responsibility for sample collection, transport, and submittal to ~~<laboratory name>~~ALS Environmental Holland, Michigan. Field personnel designated as responsible for sample custody will fill out chain-of-custody forms using the Scribe software at each sampling site, at a group of sampling sites, or at the end of each day of sampling. If the designated sampling person relinquishes samples to other sampling or field personnel, then chain-of-custody forms will be signed and dated by the appropriate personnel to document the custody transfer. Original chain-of-custody forms will accompany samples to the laboratory, and copies will be forwarded to the project files.

**Commented [SJ146]:** Mark Loomis: Providing all information missing from this draft, including identification of subcontractors and analytical laboratories that are currently identified as "TBD", and adding the analytical laboratory Standard Operating Procedures (SOPs) to Appendix A;

**Commented [EJ147R146]:** verified

The sample handling, preparation, and custody will be conducted in accordance with FOP-07, Sample Handling, Packaging, and Shipping, and FOP-10, Documentation and Chain-of-Custody Procedure (Appendix B).

### 2.5.1 Sample Containers, Handling, and Preservation

The subcontract laboratory, ALS Environmental Holland, will supply the contaminant-free sample containers used for chemical analysis in this sampling effort. Bulk sediment containers will be purchased by the sediment drilling subcontractor and decontaminated prior use in accordance with FOP-08, Field Equipment Cleaning and Decontamination *Procedures* (Appendix B). Geotechnical soil samples will be collected in sample containers and Shelby tubes and transported directly to the geotechnical laboratory by the soil ~~sediment~~ drilling subcontractor, Mateco Drilling~~Aqua Survey~~~~<sed drill sub name>~~. Geotechnical sediment samples will be collected in sample containers and transported directly to the geotechnical laboratory by the sediment subcontractor, Aqua Survey. Sample containers for analytical laboratory analyses will meet or exceed the requirements in *Specifications and Guidance for Obtaining Contaminant-Free Containers* (EPA, 1990).

Specifications for the analytical sample bottles will be verified by checking the manufacturer's certified statement and analytical results for each bottle lot. Containers will have been cleaned and certified as free of the analytes of concern for the project. No sample containers will be reused during collection activities for this project. Upon receipt of the samples, the laboratory will verify the adequacy of preservation and will add preservative as necessary. Table 4~~3~~ lists the containers, minimum sample quantities, required preservatives, and maximum holding times.

Corrective actions will be taken as soon as a problem is identified. Such actions may include discontinuing the use of a specific bottle lot, contacting the bottle suppliers for retesting the representative bottle from a suspect lot, resampling suspect samples, validating the data, taking into account that the contaminants could be introduced by the laboratory (for example, common laboratory solvents, sample-handling artifacts) as a bottle QC problem, and determining whether the bottles and data are usable.

Sample preservatives and sample holding times will meet the requirements set forth by EPA. Ice will be used to maintain the internal cooler temperature at 4 degrees Celsius (°C) plus or minus 2°C during sample collection and shipment to the laboratory for analytical samples only (effluent aqueous, elutriate aqueous and groundwater samples). Geotechnical and bulk sediment and/or soil does not require temperature maintenance.

### 2.5.2 Sample Identification System

CH2M will implement a sample numbering system that will identify each sample, including quality assurance (QA)/quality control (QC) samples. The sample number will provide a unique identifier for each sample, required by Earthsoft's Environmental Quality Information Systems (EQuIS) site management software, which is compatible with EPA's comprehensive manual for electronic data delivery format. The unique sample numbers will be assigned sequentially.

Each sample, regardless of analytical protocol, will also be assigned a site-specific identifier, which will contain the specific location identifiers to indicate where the sample was obtained. Sediment samples will also be identified using sample interval depths. The site-specific identifier is based on the following system:

- **Study Area**—The three-letter location code correlates to the study area.
  - GDA = Gorge Dam Area (sediment area)
  - CDA = Chuckery ~~Disposal~~ Area (upland geotech/groundwater)

**Commented [SJ148]:** Mark Loomis: Providing all information missing from this draft, including identification of subcontractors and analytical laboratories that are currently identified as "TBD", and adding the analytical laboratory Standard Operating Procedures (SOPs) to Appendix A;

**Commented [EJ149R148]:** Updated text for chem lab sub.

**Commented [AB150R148]:** Updated text for sediment sub

**Commented [SJ151]:** Mark Loomis: Providing all information missing from this draft, including identification of subcontractors and analytical laboratories that are currently identified as "TBD", and adding the analytical laboratory Standard Operating Procedures (SOPs) to Appendix A;

- **Sample Location Type**—the next two letters following the study area indicate the type of sample location as follows:
  - SD = sediment sample
  - SO = soil sample
  - GW = groundwater sample
  - TS = treatability--sediment
  - TW = treatability--water
  - IDW-ST = waste characterization sample solid
  - IDW-WW = waste characterization sample liquid
  - EB = equipment blank sample
  - TB = Trip blank sample
- **Location Number**—Sediment sample locations will be sequentially numbered within each of the respective subareas using three numeric digits.
- **Sample Depth**—Depth below the sediment or soil surface from which the sample was collected will be added after the station location at the end after a forward slash (/) in a top depth, bottom depth format (0 to 0.5 foot shown as 0.0/0.5).

  For example, a sediment sample collected from the 0- to 0.5-foot interval at location 026 would be indicated as GDA-SD-026-0.0/0.5. Aqueous samples do not have depth interval identifications.
- **QA/QC Identifier**—Field QA/QC samples will be identified using the following QA/QC identifiers:
  - Field duplicates, which are associated with the same station location as the native sample, will be identified with a "Z" appended to the end of the location code.
  - Matrix spike (MS)/matrix spike duplicate (MSD) samples are not identified in the station location identifier, but on the tag and the chain-of-custody form.
- **Trip Blanks**—Trip blanks will be identified using the following identifiers:
  - Trip blanks will be placed in each cooler with a VOC sample and will be identified with a "TB".
  - Trip blanks will be identified with three numeric digits starting at 001 and increasing by one for each subsequent sample and ending with the sample date (GDA-TB-001-MMDDYY is the first trip blank used during the field event, GDA-TB-008-MMDDYY would be the eighth trip blank used during the sediment field event).
- **Equipment Blanks**—Equipment blanks will be identified using the following identifiers:
  - Equipment blanks will be taken on the nondisposable equipment and will be identified with an "EB"
  - Equipment blanks will be identified with three numeric digits starting at 001 and increasing by one for each subsequent sample and ending with the sample date (GDA-EB-001-MMDDYY is the first equipment blank used during the field event, GDA-EB-008-MMDDYY would be the eighth equipment blank used during the sediment field event).

Sample identification examples:

- GDA-SD-003-0.0/0.5 is a sediment sample from location 003 from 0- to 0.5-foot interval

- CDA-GW-002 is a groundwater from location 002

**Bulk treatability samples**—Bulk sediment treatability samples will be identified by the study area, location ID name, location number, and sample depth (GDA-TS-001-0.0/10). Bulk water treatability samples will be identified by the study area, location ID name, and location number and sample number, depths are not included. (GDA-TW-002-01)

### 2.5.3 Sample Packaging

Sample handling, packaging, and shipping procedures are described in FOP-07, Sample Handling, Packaging, and Shipping (Appendix B). Sample coolers will be shipped to arrive at the subcontract analytical laboratory the morning after sampling (priority overnight) or sent by courier to arrive the same day. The laboratory will be notified of the sample shipment and the estimated date of arrival of the samples being delivered. When samples are shipped, the air bill number will be documented on the chain-of-custody form accompanying the samples to the laboratory for sample tracking purposes. Completed air bills will accompany shipped samples to the laboratory and be forwarded along with data packages. The air bills will be kept as part of the project files to provide a record for sample shipment to the laboratory.

### 2.5.4 Sample Custody

Accurate records and control of samples, including their controlled custody, are necessary to provide relevant and defensible data. The chain of custody is addressed during field sample collection, data analyses in the laboratory, and through proper handling of project files. Persons will be considered to have custody of samples when samples are in their physical possession, in their view after being in their possession, or in their physical possession and secured to prevent tampering. When samples are secured in a restricted area accessible only to authorized personnel, they will be deemed to be in the custody of such personnel.

Chain-of-custody forms will provide the record of responsibility for sample collection, transport, and submittal to the laboratory. Field personnel designated as responsible for sample custody will fill out chain-of-custody forms at each sampling site, at a group of sampling sites, or at the end of each day of sampling. If the designated sampling person relinquishes samples to other sampling or field personnel, chain-of-custody forms will be signed and dated by the appropriate personnel to document the custody transfer. Original chain-of-custody forms will accompany samples to the laboratory, and copies will be forwarded to the project files.

#### 2.5.4.1 Field Custody Procedures

For samples collected for analysis (chemical and geotechnical), EPA chain-of-custody protocols will be followed, as described in the *National Enforcement Investigations Center (NEIC) Policies and Procedures* (EPA, 1991). Chain-of-custody forms will be completed using EPA's Scribe software. The protocol for filling out the chain-of-custody form is provided in FOP-10, Documentation and Chain-of Custody Procedure (Appendix B).

Chain-of-custody forms are required for all samples. The sampling crew in the field will initiate chain-of-custody forms, which will contain the sample's unique identification, sample date and time, sample type, preservation (if any), and analyses required. Hard copy original chain-of-custody forms, signed by the sampling crew in the field, will accompany the samples to the laboratory. A copy of relinquished chain-of-custody forms will be retained with the field documentation. Chain-of-custody forms will remain with the samples at all times. Samples and signed chain-of-custody forms will remain in the sampling crew's possession or within view until samples are delivered to the express carrier (such as FedEx), hand-delivered to the laboratory, or placed in secure storage.

The bulk sediment and water samples for treatability testing will be transported by the subcontractor to the appropriate lab.

#### 2.5.4.2 Laboratory Custody Procedures

Laboratory custody procedures will be in place for the integrity of sample and laboratory data handling.

#### 2.5.4.3 Laboratory Sample Receipt

Upon receipt of samples, the laboratory sample custodian will verify package seals, open the packages, check temperature blanks (and record temperatures), verify sample integrity, and inspect contents against chain-of-custody forms. The laboratory project manager will contact the CH2M project chemist to resolve any discrepancies between sample containers and chain-of-custody forms. Once the shipment and chain-of-custody form are in agreement, the sample custodian will initiate an internal chain-of-custody form as well as supply the CH2M project chemist with a sample acknowledgement letter or e-mail. When applicable, sample preservation will be checked, and pH documented. If the sample temperatures are outside the required range, the laboratory will contact the project chemist for direction on the proper course of action.

Samples will be logged into the laboratory information management system (LIMS), which will assign a unique laboratory number to each sample. The system will be used by the laboratory personnel who handle samples to ensure that all sample information is captured. The required analyses will be specified by codes assigned to samples at login. Labels containing the laboratory sample number will be generated and placed on sample bottles.

#### 2.5.4.4 Laboratory Sample Storage

After the laboratory labels the samples, they will be moved to locked or limited-access refrigerators and maintained at 4°C plus or minus 2°C. Access to refrigerators will be limited to members of the sample management department.

When the samples are needed, an appropriate member of the sample management department will locate the samples in the locked or secure limited-access refrigerator, sign and date the internal sample tracking form, and provide the samples to the analyst. When the analyst is finished with samples, unused portions will be returned to an appropriate member of the sample management department for replacement in a secure refrigerator.

The analyst will sign and date internal chain-of-custody forms. If entire samples are depleted during analysis, a notation of "sample depleted" or "entire sample used" will be made on the internal chain-of-custody forms.

Sample extracts will be stored in designated secure, refrigerated storage areas. Samples and sample extracts will be maintained in secure storage until disposal. No samples, extracts, or archived samples will be disposed of without prior written approval from an appropriate member of the project team. The sample custodian will note sample disposal dates in the sample ledger. The laboratory will dispose of samples in accordance with applicable regulations.

#### 2.5.4.5 Laboratory Logbooks

Workbooks, bench sheets, instrument logbooks, and instrument printouts will be used to trace the history of samples through the analytical process and document important aspects of the work, including associated QC. Therefore, all logbooks, bench sheets, instrument logs, and instrument printouts will be part of the laboratory's permanent record. Relevant information will be entered into the LIMS at the time it is generated.

The analyst will date and initial each page or entry at the time of entry. Errors will be crossed out in indelible ink with a single stroke, corrected without obliterating or writing directly over the erroneous entry, and initialed and dated by the individual making the correction. Unused pages will be completed by lining out unused portions and initialing.

The analyst will record information about the sample, the analytical procedures performed, and the results on laboratory forms or personal notebook pages and enter this information in the LIMS. The notes will be dated and will identify the analyst, instruments used, and instrument conditions.

Sufficient raw data records must be retained to permit reconstruction of initial instrument calibrations (for example, calibration date, test method, instrument, analysis date, each analyte name, concentrations and responses, calibration curves, response factors, or unique equations or coefficients used to reduce instrument responses into concentrations).

The laboratory group leaders will periodically review laboratory notebooks for accuracy, completeness, and compliance with this SAP. The laboratory group leader will verify all entries and calculations. If all entries on the pages are correct, the laboratory group leader will initial and date the pages. Incorrect entries will be corrected before the laboratory group leader signs.

#### 2.5.4.6 Laboratory Project File

Documentation will be placed in a single, secured project file, maintained by the laboratory project manager. The file will consist of the following components, filed chronologically:

- Agreements
- Correspondence
- Memorandums
- Notes and data

Reports (including QA reports) will be filed with correspondence. Analytical laboratory documentation and field data will be filed with notes and data. Filed materials may be removed only by authorized personnel and only temporarily. The name of the person removing the file will be recorded. Laboratories will retain project files and data packages for at least 5 years, unless otherwise agreed.

#### 2.5.4.7 General Deliverable Specifications

One copy of the analytical report in PDF shall be provided within 21 calendar days of receipt of the first sample in a sample delivery group (SDG). In addition, one copy of the EDD must be provided within 21 calendar days of receipt of the first sample in an SDG.

#### 2.5.4.8 Electronic Files and Hard Copy Storage

CH2M will maintain electronic files for 10 years. Electronic files a should include notation of instrument-run files and calibration.

## 2.6 Analytical Method Requirements

Once the samples have been properly collected, documented, and successfully shipped, the subcontract laboratories will use their promulgated analytical procedures as described in the standard operating procedures (SOPs in Appendix B~~A~~) to analyze the samples. The quantification limits for the analyses to be performed during the investigation are presented in Table 6~~5~~. Mateco Drilling ~~Company~~ will perform the geotechnical analyses for soil and Aqua Survey will perform the geotechnical analyses for sediment as presented in Table 5~~4~~. ~~<Chem Lab name>~~ALS Environmental Holland, will perform chemical analyses listed in Table 6 and 8~~7~~. The laboratories will use their methods and procedures as specified in Table 8~~7~~.

Commented [SJ152]: Mark Loomis: Providing all information missing from this draft, including identification of subcontractors and analytical laboratories that are currently identified as "TBD", and adding the analytical laboratory Standard Operating Procedures (SOPs) to Appendix A;

Commented [EJ153R152]: Lab SOPs were added to Appendix B (17 total SOPs)

The laboratory will use analytical SOPs to ensure that the samples are analyzed accurately and precisely. The procedures reflect the requirements of the stated methods while including internal QC criteria.

| SOP Number | Title |
|---|---|
| SOP-01 | Liquid-Liquid Extraction (Separatory Funnel) SW846 3510C/EPA 608/EPA 610/EPA 625 |
| SOP-02 | Toxicity Characteristic Leaching Procedure – Non-Volatile Extraction SW846 1311 |
| SOP-03 | Toxicity Characteristic Leaching Procedure – Zero Headspace Extraction SW846 1311 |
| SOP-04 | Herbicide Derivatization - BF3 Supleco™ BF3 Method |
| SOP-05 | Organic Compounds in Water by Microextraction SW846 3511 |
| SOP-06 | Organochlorine Pesticides SW846 8081A/ 8081B/EPA 608.3 |
| SOP-07 | Polychlorinated Biphenyls SW846 3032/ 8082A |
| SOP-08 | Chlorinated Herbicides SW846 8151A |
| SOP-09 | Mercury – Aqueous EPA 245.1/SW846 7470A |
| SOP-10 | Metal by ICP-MS EPA 200.8/SW846 6020A/SW846 6020B |
| SOP-11 | Microwave Assisted Acid Digestion of Aqueous Samples and Extracts for Total Metals Analysis by ICP or ICP-MS Spectroscopy EPA 3015A/CEM-NPDES |
| SOP-12 | Semi-Volatile Organic Compounds SW846 8270C/ 8270D/EPA 625.1 |
| SOP-13 | Volatile Organic Compounds SW846 8260B, 8260C, 8260D and 5030C, EPA 1666, EPA 1666A, EPA 624 and EPA 624.1 |
| SOP-14 | Alkalinity SM 2320B-11/SM 4500CO2 D-11 |
| SOP-15 | pH Measurement SM4500-H B/EPA 150.1/SW9040C/SW9045D |
| SOP-16 | Total Suspended, Volatile suspended and Dissolved Solids EPA 160.1, 2, 4/ SM2540 C, D, E-11 |
| SOP-17 | Flash Point by Pensky-Martins Closed cup SW846 1010A/ASTM D93-80 |

The QC criteria used during the analyses will be those stated within the SOPs, which provide details of the corrective action plans for the analytical method requirements. See Tables 5~~4~~ and 8~~7~~ for the complete listing of the analytical and geotechnical methods to be used for sample analysis on this project.

## 2.7 Quality Control Requirements

The analytical laboratory has a QC program to assess the reliability and validity of the analyses being performed. The purpose and creation of QC samples are discussed and summarized in the following subsections.

### 2.7.1 Field Quality Control Samples

QC samples will be collected to monitor accuracy, precision, and presence of field contamination. The minimum frequency for the collection of QC samples, as outlined in the following subsections, is recommended and should be reviewed and updated in accordance with the DQOs of the project. The quality (control limit acceptance or blank detections) of the QC samples will be discussed in the data usability report.

#### 2.7.1.1 Field Duplicate Samples

A field duplicate is a split sample collected from the same groundwater sample, and is used to measure heterogeneity of the matrix, analytical precision, and representativeness. Field duplicates will be collected from piezometers at the disposal areas at a minimum frequency of 10 percent during the one-time initial sampling event. Field duplicate sample information will be documented in the chain-of-custody form, along with regular field samples, so that the laboratory can determine the duplicate–parent sample relationship. A control limit of plus or minus 25 percent relative percent difference (RPD) will be used for native and duplicate sample values greater than or equal to five times the reporting limit.

**Commented [MG154]:** Each month or only during initial sampling event?

**Commented [WD155R154]:** Ground water samples will only be collected once, during installation. Ground water levels will be recorded monthly, at a minimum.

#### 2.7.1.2 Equipment Blanks

Since disposable equipment will be used, it is not anticipated that equipment rinsate blanks will be collected. If an equipment blank is deemed necessary, ASTM International (ASTM) Type II deionized water will be poured over the decontaminated equipment. One blank would be collected per week if deemed necessary for each equipment type that is decontaminated and would be analyzed for the same parameters as those specified for the corresponding matrix. Equipment blanks are not planned to be collected.

#### 2.7.1.3 Matrix Spike/Matrix Spike Duplicate

An MS/MSD consists of duplicate field sample aliquots spiked by the laboratory with analytes of concern to evaluate the effects of the matrix on the recovery of analytes. MS/MSD samples will be collected at a minimum frequency of 5 percent and designated on the chain-of-custody form for use as MS/MSD by the laboratory. The duplicate aliquots for MS/MSD analyses should be collected simultaneously or in immediate succession with the parent sample from groundwater samples collected at piezometers within the disposal area. They will be treated in exactly the same manner as the parent sample during storage and shipment. The sampling locations for the MS/MSD will be documented in the field logbook. MS/MSD samples will be collected for the applicable analytical methods. MS/MSD samples will only be collected for groundwater samples.

#### 2.7.1.4 Temperature Blanks

A temperature blank will be included in each cooler to allow the laboratory receiving the shipment of samples to determine whether the samples have been maintained at the proper temperature. Temperature blanks will consist of an unpreserved sample container filled with distilled water. One temperature blank will accompany each sample cooler being shipped to the laboratory. Temperatures should be between 0°C and 6°C.

#### 2.7.1.5 Trip Blanks

Trip blanks will be used to assess the potential introduction of contaminants to VOC sample containers during field events and during shipment of empty bottles to the site and samples to the laboratory. The trip blank consists of a VOC sample vial filled at the laboratory with laboratory grade deionized water. It is transported to the site in the same manner as the other sampling containers, stored with the samples in the field, and then returned to the laboratory for analysis. One trip blank will be included in each sample cooler containing VOC samples.

### 2.7.2 Data Precision, Accuracy, and Completeness

Field QA/QC samples and laboratory internal QA/QC samples are collected and analyzed to assess data usability. The laboratory scope of work and analytical SOPs state acceptance criteria for precision and accuracy requirements for the QC samples. The QA/QC criteria for internal laboratory QC samples not referenced in the appropriate analytical SOPs will be those stated in the referenced methods.

Completeness is the percentage of usable data (not qualified with an "R" indicating rejected during data validation) obtained during the sampling event.

PARCC parameters indicate data quality. Ideally, the intended use of the measurement data should define the necessary PARCC parameters. Both definitive and screening data will be subject to PARCC requirements. PARCC objectives for screening methods may be identical to those of definitive data as recommended in the following subsection, but the requirements may be decreased or increased depending on the project-specific objectives. The frequencies in the following subsection may vary according to the project needs.

### 2.7.2.1 Precision

Precision is a measure of reproducibility of analytical results. It can be defined as the degree of mutual agreement among individual measurements obtained under similar conditions. Total precision is a function of the variability associated with both the field sampling techniques as well as the laboratory analytical processes. Homogeneity of the field duplicate sample(s) will be evaluated according to the quantitation values of detected target compounds/analytes that yield relative to the values given by their associated parent samples. Field duplicate samples will be collected at a 10 percent frequency (one field duplicate for every 10 normal samples). Precision will be evaluated as the RPD between the MS and MSD results. MS/MSD samples will be field-designated at a 5 percent frequency (one MS and one MSD collected for every 20 normal samples).

### 2.7.2.2 Accuracy

Accuracy is the degree of agreement between a measured value and the "true" or expected value. It represents an estimate of total error from a single measurement, including both systematic or matrix error (bias) and random error that may reflect variability resulting from imprecision. Accuracy is evaluated in terms of percent recoveries determined from results of MS/MSD and laboratory control sample (LCS) analyses. Surrogate recoveries from samples analyzed for organic parameters are also used to assess accuracy.

### 2.7.2.3 Representativeness

Representativeness is the degree to which sample data accurately reflect the characteristics of a population of samples. It is achieved through a well-designed sampling program and by using standardized sampling strategies and techniques and analytical procedures. Factors that can affect representativeness include site homogeneity, sample homogeneity at a single point, and available information around which the sampling program is designed. Using multiple methods to measure an analyte can also result in nonrepresentativeness of sample data.

### 2.7.2.4 Completeness

Completeness is the amount of valid measurements compared with the total amount generated. It will be determined for each method, matrix, and analyte combination. The completeness goals of each project are optimized to meet the DQOs. The goal for this project is 90 percent for sediment, soil and aqueous samples.

**Commented [MG156]:** Why not needed for other samples?

**Commented [EJ157R156]:** Added the other matrix text. We need meet the 90% for Geotech analysis and any chem analysis for completeness.

### 2.7.2.5 Comparability

Comparability is the confidence with which one data set can be compared with another. It is achieved by maintaining standard techniques and procedures for collecting and analyzing samples and reporting the analytical results in standard units. Results of performance evaluation samples and systems audits will provide additional information for assessing comparability of data among participating subcontractor laboratories, if applicable.

#### 2.7.2.6 Sensitivity

Sensitivity is defined as the ability of the method or instrument to detect the contaminant of concern and other target compounds at the level of interest. Appropriate sampling and analytical methods will be selected that have QC acceptance limits that support the achievement of established performance criteria. Assessment of sensitivity will require thorough data validation.

### 2.7.3 Method Detection Limits

The MDL is the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero. Each participating laboratory will determine the MDL for each method, matrix, and analyte for each type of instrument that will be used during analysis. MDLs initially will be determined before analyzing samples, and then determined again at least once every 12 months. The following is the procedure for determining MDL.

1. Estimate the MDL using one of the following:
    a. The concentration value that corresponds to an instrument signal/noise ratio in the range of 2.5 to 5.
    b. The concentration equivalent of three times the standard deviation of replicate measurement of the analyte in reagent water.
    c. The region of the standard curve where there is a significant change in sensitivity (that is, a break in the slope of the standard curve).
2. Prepare (for example, extract, digest) and analyze seven samples of an MS (ASTM Type II water for aqueous methods, Ottawa sand for soil methods, glass or Teflon beads 1 millimeter in diameter or smaller for metals) containing the analyte of interest at a concentration three to five times the estimated MDL.
3. Determine the variance ($S^2$) for each analyte as follows:

$$S^2 = \frac{1}{n-1}\left[\sum_{i=1}^{n}\left(x_i - \bar{x}\right)^2\right] \quad (1)$$

where:

$x_i$ = the $n$th measurement of the variable x

$\bar{X}$ = the average value of $x$

$$\bar{X} = \frac{1}{n}\sum_{i=1}^{n} x_i \quad (2)$$

4. Determine the standard deviation for each analyte as follows:

    $s = (S^2)^{1/2}$

5. Determine the MDL for each analyte as follows:

    MDL = 3.14(s)

    (3.14 is the one-sided *t*-statistic at the 99 percent confidence level appropriate for determining the MDL using seven samples.)

6. If the spike level used in Step 2 is more than 10 times the calculated MDL, repeat the process using a smaller spiking level.

### 2.7.4 Reporting Limits

Reporting limits should be, at a minimum, greater than two times the calculated MDL. When calibrating instruments, a standard at a concentration equal to or less than the reporting limit must be included. The reporting limits specified in Table 7~~6~~ were established for each analysis in order to meet the data quality objectives described in Table 2~~1~~. The limits meet contractual requirements and have been determined to be attainable by the laboratory's methods.

**Commented [SJ158]:** Section 2.7.4, Tables 5 and 6 – Section 2.7.4 (Reporting Limits) provides descriptions and requirements for reporting limits (RLs) and method detection limits (MDLs); however, Table 5 (Waste Characterization Parameters and Action Limits (Solid and Aqueous)) and Table 6 (Method Reporting Limits) report no RLs or MDLs for the parameters and matrices listed. These tables should be completed.

**Commented [EJ159R158]:** Tables have been completed

Reporting requirements will be established as follows: the reporting limit for the sample will be adjusted for actual sample size, moisture content, and dilutions. Results above the sample-specific reporting limit will be reported without flags. Results between the MDL and the sample-specific reporting limit will be reported but qualified with the "J" flag, and results for analytes not detected will be qualified "U" and reported at the MDL.

RLs and sample results will be reported to two significant figures if less than 10 and to 3 significant figures otherwise and RLs will be reported on a dry-weight basis for sediment samples for CLP inorganics. CLP organics will be reported to two significant figures at any concentration.

## 2.8 Instrument and Equipment Testing, Inspection, and Maintenance Requirements

### 2.8.1 Field Instrument Maintenance

Field equipment will be calibrated daily according to the manufacturer's specifications and checked for indications of poor performance, and the results will be documented. Discrepancies will be reported immediately to the appropriate personnel for resolution. The field team will maintain a sufficient supply of spare parts to minimize downtime. Whenever possible, backup instrumentation will be on hand.

The field equipment will be maintained as stated in the operating manual. The equipment to be used in taking field measurements includes a submeter GPS unit and pressure transducers.

#### 2.8.1.1 GPS Calibration

Navigation of the GPS equipment will be checked each morning by recording the *x*,*y* coordinates of a known benchmark. The coordinates will be recorded in the field logbook and compared with the benchmark to verify that the GPS equipment is functioning consistently. No additional equipment outside of that used for surveying purposes (collection of *x*,*y* coordinates and *z* elevations) during the investigation will require calibration.

### 2.8.2 Laboratory Equipment and Instruments

Only qualified personnel will service instruments and equipment. Repairs, adjustments, and calibrations will be documented in the appropriate logbook or data sheet.

#### 2.8.2.1 Instrument Maintenance

Preventive maintenance of laboratory equipment will follow guidelines recommended by the manufacturer. Malfunctioning instruments will be repaired by in-house staff or the manufacturer. The laboratory will maintain a sufficient supply of spare parts for its instruments to minimize downtime. Whenever possible, backup instrumentation will be on hand.

Whenever practical, analytical equipment should be maintained under a service contract. Such contracts allow for preventive system maintenance and repair as needed. The laboratory should have sufficiently trained staff to allow for the day-to-day maintenance of equipment. All laboratory instruments will be maintained in accordance with manufacturer's specifications and within the requirements of the laboratory's internal quality assurance manual.

Preventive maintenance for analyses is described in the laboratory scope of work. All maintenance activities must be documented in the logbooks to provide a history of maintenance records.

#### 2.8.2.2 Equipment Monitoring

Operation of balances, ovens, refrigerators, and water purification systems will be checked daily and documented. Discrepancies will be reported immediately to the appropriate laboratory personnel for resolution.

Specific laboratory preventive maintenance procedures are found in the laboratory's internal QA manual.

## 2.9 Laboratory Quality Control/Instrument Calibration and Frequency

Laboratory QC checks indicate the state of control prevailing at the time of sample analysis and include calibrations, method blanks, and LCSs. QC checks that involve field samples, such as MS, surrogate spikes, field duplicates, and laboratory sample duplicates, provide an indication of the presence of matrix effects. Field-originated blanks provide a way to monitor for potential contamination of field samples.

All QC will be in accordance with method specifications, including the following:

- Method blanks
- Holding time
- Initial calibrations
- Continuing calibrations
- Second source check samples
- Instrument tuning
- LCS
- MS/MSD
- Surrogate spikes
- Postdigestion spikes and serial dilutions
- Internal standards
- Retention time window studies

### 2.9.1 Analytical Batch

A laboratory QC batch is defined as 20 or fewer environmental samples of similar matrix that are extracted or analyzed together and contain a method blank, an LCS, an MS/MSD, or a sample duplicate, depending upon the method. For gas chromatography/mass spectrometry volatile analyses, a method blank, LCS, and MS/MSD must be analyzed in each 12-hour period, unless otherwise described in the SOW technical requirements. The number of environmental samples allowed in the laboratory QC batch is defined by the remaining time in the method-prescribed 12-hour period divided by the analytical run time. Each preparation or analytical batch should be identified in a way that allows environmental samples to be associated with the appropriate laboratory QC samples.

### 2.9.2 Instrument Calibration and Frequency

Laboratory instruments will be calibrated by qualified personnel before sample analysis according to the procedures specified in each method. Calibration will be verified at method-specified intervals throughout the analysis sequence. The frequency and acceptance criteria for calibration are specified for each analytical method, with supplemental requirements defined in the following subsections for methods used to determine organic compounds. When multipoint calibration is specified, the concentrations of the calibration standards should bracket those expected in the samples. Samples should be diluted, if necessary, to bring analyte responses within the calibration range. The laboratory cannot report data that exceed the calibration range. The initial calibration curve will be verified as accurate using a standard purchased or prepared from an independent second source, Sample Management Office methods will use midpoint and not an independent second source. The initial calibration verification involves the analysis of a standard containing all the target analytes, typically in the middle of the calibration range, each time the initial calibration is performed. Quantitation based on extrapolation is not allowed.

#### 2.9.2.1 Initial Calibration Models for Determining Organic Compounds

Methods for determining organic compounds often provide multiple options for initial calibration curve fits and associated acceptance criteria for use. The following sections outline required good laboratory practices that will be employed by the laboratory. The hierarchy the laboratory will use when selecting the calibration curve fit for use in quantitation of sample results is outlined in the following section.

#### 2.9.2.2 Calibration Techniques

The analyst will verify that correct instrument operating conditions and routine maintenance as specified in the method and laboratory SOP are employed. The laboratory must follow calibration techniques as specified in its specific SOPs and quality assurance manual. All maintenance will be documented in a laboratory notebook for troubleshooting and scheduling of future routine, periodic maintenance.

Personnel will ensure that the instrument is free of contamination before calibration and will not perform any blank subtraction.

The entire initial calibration must be performed prior to sample analysis. The calibration standards must be analyzed in a sequential order from lowest concentration to highest, or highest to lowest depending on the method. If one calibration standard fails to meet criteria, it may be reanalyzed at the end of the calibration sequence. Justification for removing a calibration point from the curve fit selected includes improper purge, injection failure, nonspiked level, or other obvious failures. The failure of multiple standards suggests an instrument problem or operator error, and corrective action is required.

Only the lowest calibration point or the highest calibration point can be removed from the calibration curve without justification. If the lowest standard is removed, the reporting limit for that compound increases to the level of the next lowest calibration standard. Elevating reporting limits to greater than the project-specific objectives must be approved by the project chemist. If the highest standard is removed, the linear range is shortened for that compound. At all times, five calibration points must be included.

The lowest standard in the calibration curve must be at or below the required reporting limit. The other standard concentrations must define the working range of the instrument or the expected range of concentrations found in the samples.

Either external or internal standard calibration can be employed for methods not involving mass spectrometry detectors. Internal standard calibration must be used when a mass spectrometry detector is employed. The “mass spectrometry detector” includes inductively coupled plasma-mass spectrometry-type instruments, which must be used according to project requirements.

Most compounds tend to exhibit a linear response from the instrument, and a linear approach should be favored when linearity is suggested by the calibration data. Nonlinear calibration should be considered only when a linear approach cannot be applied. It is not acceptable to use an alternate calibration procedure when a compound fails to perform in the usual manner. When this occurs, it indicates instrument issues or operator error.

If a nonlinear calibration curve fit is employed, a minimum of six calibration levels must be used for second-order (quadratic) curves, and a third-order polynomial requires at least seven calibration levels. When more than five levels of standards are analyzed in anticipation of using second- or third-order calibration curves, all calibration points must be used, regardless of the calibration option employed. The highest or lowest calibration point may be excluded to narrow the calibration range and meet the requirements for a specific calibration option; otherwise, unjustified exclusion of calibration data is expressly forbidden.

Use of the average of all compound relative standard deviations in a calibration curve at less than the criteria are not allowed. Calibration control must be shown for each individual compound.

#### 2.9.2.3 Calibration Options

The acceptable calibration options are described below and presented in the hierarchy the laboratory should use when selecting a specific option. The choice of calibration option may be based on previous experience or prior knowledge of detector response and will be consistent with specific calibration requirements described in the analytical method. It is not the intent of alternate calibration models to compensate for poor instrument operating conditions or extending requirements for instrument maintenance. Possible calibration options include:

- **Linear Calibration Using Average Calibration or Response Factors.**

  Calibration factors for external calibrations or relative response factors (RFs) for internal calibrations must have relative standard deviations not exceeding 20 percent or 15 percent, respectively, to be used for quantitation. As a general rule, minimum RF of 0.05 for most target analytes and 0.01 for the least responsive target analytes must be achieved to ensure detectability or the minimum relative RF criteria or relative standard deviation is defined by the method requirements.

- **Linear Calibration Using a Linear Regression Equation (y = mx + b).**

  The correlation coefficient must equal 0.995 or more. The equation and a plot of the linear regression must be included in the raw data to be generated by the laboratory and made available in the data package upon the client's request.

- **A Nonlinear Calibration.**

  The model may be a second- or third-order polynomial. The model must be continuous without a break in the function and should *not* be forced through the origin. The coefficient of determination of the nonlinear regression should be 0.99 or greater, refer to the analytical method. The equation and a plot of the nonlinear regression must be included in the raw data to be generated by the laboratory and presented in the data package.

#### 2.9.2.4 Continuing Calibration

Periodic verification of the initial calibration is essential in generating analytical data of known quality. The continuing calibration verification analyses ensure that the instrument has not been adversely affected by the sample matrix or other instrument failures that would increase or decrease the sensitivity or accuracy of the method. The laboratory will perform continuing calibration for all methods according to the specific requirements in the method and laboratory SOP.

Use of the average of all analytes' percent drift or recovery to meet the continuing calibration requirements for the method is not allowed. If the laboratory accepts a continuing calibration as compliant, but individual compounds exceed criteria, a list of those analytes that exceeded the criteria will be provided in the laboratory report. For analyses conducted under this SAP, notifications will be accomplished by listing in the laboratory case narrative the compounds outside the criteria and the actual values of the percent drift or recovery.

### 2.9.3 Method Blanks

Blanks are used to monitor each preparation or analytical batch for interference and/or contamination from glassware, reagents, and other potential contaminant sources within the laboratory. A method blank is an analyte-free matrix (laboratory reagent water for aqueous samples, Ottawa sand or sodium sulfate [CLP method requirements] for soil samples, and glass or Teflon beads 1 millimeter in diameter or smaller for metals) to which all reagents are added in the same amounts or proportions as are added to samples. The blank is run through the entire sample preparation and analytical process, along with the samples in the batch. At least one method blank should be used per preparation or analytical batch. If a target analyte is found at a concentration that exceeds the reporting limit, corrective action must be taken to identify and eliminate the contamination source. All associated samples must be reprepared and/or reanalyzed after the contamination source has been eliminated. No analytical data may be corrected for the concentration found in the blank.

### 2.9.4 Laboratory Control Sample

The LCS will consist of analyte-free matrix (laboratory reagent water for aqueous samples or Ottawa sand for soil samples) spiked with known amounts of analytes that come from a source different from that used for calibration standards. Target analytes specified in the SAP will be spiked into the LCS. The spike levels should be less than or equal to the midpoint of the calibration range. If LCS results are outside the specified control limits, corrective action must be taken, including sample re-preparation or reanalysis, if appropriate. If more than one LCS is analyzed in a preparation or analytical batch, the results of all LCSs must be reported. Any LCS recovery outside of QC limits affects the accuracy for the entire batch and requires corrective action.

### 2.9.5 Surrogates

Surrogates are organic analytes that behave similarly as the analytes of interest but are not expected to occur naturally in the samples. They are spiked into the standards and into the samples and QC samples prior to sample preparation. Recoveries of surrogates are used as an indicator of accuracy, method performance, and extraction efficiency. If surrogate recoveries are outside the specified control limits, corrective action must be taken, including sample repreparation or reanalysis, if appropriate.

### 2.9.6 Matrix Spike/Matrix Spike Duplicate

As described, an MS is a sample matrix fortified with known quantities of specific compounds. It is subjected to the same preparation and analytical procedures as the native sample. Target analytes specified in the SAP are spiked into the sample. MS recoveries are used to evaluate the effect of the sample matrix on the recovery of the analytes of interest. An MSD is a second fortified sample matrix. The RPD between the results of the duplicate MSs measures the precision of sample results. Only project-specific samples designated on the chain-of-custody form will be spiked. The spike levels will be less than or equal to the midpoint of the calibration range.

### 2.9.7 Internal Standards

Some methods require the use of internal standards to compensate for losses during injection or purging, or losses resulting from viscosity. Internal standards are compounds that have similar properties as the analytes of interest but are not expected to occur naturally in the samples. A measured amount of the internal standard is added to the standards and to the samples and QC samples following preparation. When the internal standard results are outside the control limits, corrective action must be taken, including sample reanalysis, if appropriate.

### 2.9.8 Laboratory Sample Duplicate

A sample duplicate selected by the laboratory is called a laboratory sample duplicate. It is subjected to the same preparation and analytical procedures as the native sample. The RPD between the results of the native sample and of the laboratory sample duplicate indicates the precision of sample results. The data collected may also yield information on whether the sample matrix is homogenous or heterogeneous.

### 2.9.9 Interference Check Samples

Interference check samples are used in inductively coupled plasma analyses to verify background and inter-element correction factors. They consist of two solutions. Solution A contains the interfering analytes. Solution B contains both the analytes of interest and the interfering analytes. Both solutions are analyzed at the beginning and at the end of each analytical sequence. When the interference check sample results are outside the control limits, corrective action must be taken, including sample reanalysis, if appropriate.

### 2.9.10 Retention Time Windows

Retention time windows for gas and liquid chromatographic analyses must be established by replicate injections of the calibration standard over multiple days as described in SW-846 8000C. The absolute retention time of the calibration verification standard at the start of each analytical sequence will be used as the centerline of the window. In order for an analyte to be reported as positive, its elution time must be within the retention time window.

### 2.9.11 Holding Time

The holding time requirements specified in this SAP must be met. For methods requiring both sample preparation and analysis, the preparation holding time will be calculated from the time of sampling to the completion of preparation. The analysis holding time will be calculated from the time of completion of preparation to the time of completion of the analysis, including any required dilutions, confirmation analysis, and reanalysis. For methods requiring analysis only, the holding time is calculated from the time of sampling to completion of the analysis, including any required dilutions, confirmation analysis, and reanalysis.

### 2.9.12 Confirmation

Confirmation analysis must be carried out as specified for specific methods when the result is at or above the reporting limit. The result designated as the primary result will be reported but may be reported from the confirmation column if there is a confirmed positive bias from interference on the primary column. The laboratory will follow its specific SOP on reporting confirmation data, and in all cases, confirmation data will be clearly annotated in the data package during such an occurrence. All calibration and QC requirements must be met when confirmation analysis is performed.

### 2.9.13 Cleanup Procedures to Minimize Matrix Effects

To maintain the lowest possible RLs, appropriate cleanup procedures should be employed when indicated by the method used to remove or minimize matrix interference. Methods for sample cleanup include gel permeation chromatography, silica gel, alumna, florisil, mercury (sulfur removal), sulfuric acid, and acid/base partitioning. Method blanks, MS/MSDs, and LCSs must be subjected to the same cleanup procedures as those performed on the samples to monitor the efficiencies of the procedures.

### 2.9.14 Sample Dilution

Sample dilution results in elevated reporting limits and ultimately affects the usability of the data related to potential actions at the sampling site. It is important to minimize dilutions and maintain the lowest possible reporting limits. When dilutions are necessary because of high concentrations of target analytes, lesser dilutions should also be reported to fully characterize the sample for each analyte. The level of the lesser dilution should be such that it will provide the lowest possible reporting limits without a lasting deleterious effect on the analytical instrumentation.

When a sample exhibits characteristics of matrix interference that are identified through analytical measurement or visual observation, appropriate cleanup procedures must be proven ineffective or inappropriate, prior to proceeding with dilution and analysis.

### 2.9.15 Standard Materials and Other Supplies and Consumables

Standard materials must be of known high purity and must be traceable to an approved source. Pure standards must not exceed the manufacturer's expiration date or 1 year following receipt, whichever comes first. Neat standards (used in the wet chemistry tests) allow up to 5 years before expiration. Solutions prepared by the laboratory from the pure standards must be used within the expiration date specified in the laboratory's SOP. All other supplies and consumables must be inspected before use to ensure that they meet the requirements specified in the appropriate SOP. The laboratory's inventory and storage system should ensure their use within the manufacturer's expiration date and storage under proper conditions.

### 2.9.16 Manual Integration

The laboratory is required to train all analysts performing methods that rely on interpretation of chromatographic data on appropriate software or manual integration practices. The laboratory also must strive to minimize the use of manual integration of data. If manual integration is required to correct a software auto integration error, the manual integration will be clearly identified in the instrument data. "Before" and "after" enlargements of the region of the chromatogram where the manual integration was performed will be provided on an appropriate scale that allows an independent reviewer to evaluate the need for and quality of the manual integration.

The analyst will document the reason for the manual integration, the laboratory manager or designee will review and approve the manual integration. The initials of the analyst and reviewer will be documented in electronic format.

## 2.10 Inspection and Acceptance Requirements for Supplies and Consumables

It is expected that several subcontractors will provide various services to multiple project tasks. The required services must meet the task scope, specified levels of quality, and the submittal schedule. Project subcontractors or vendors should have contractual arrangements with their suppliers. Field supplies and equipment will be procured as part of the contract and maintained by the technical team.

Supplies and equipment will be acquired and initially inspected by equipment specialist personnel located at the CH2M warehouses. The subcontractor on this project will use their own specialized field equipment or will acquire the equipment appropriate for the task through commercial vendors (rental companies). Before use at the project site, equipment will be visually inspected and tested by the field team leader upon receipt or installation to verify that the correct materials and services were received and that they can meet contractual arrangements and the requirements specified in the project site-specific plans.

## 2.11 Data Acquisition Requirements for Nondirect Measurements

Data acquired from nondirect measurements include the following:

- Physical information, such as descriptions of sampling activities and geologic logs
- State and local environmental agency files
- Reference computer databases and literature files
- Historical reports and subjective information gathered through interviews

## 2.12 Data Management Plan

The data management plan outlines the procedures for storing, handling, accessing, and securing data collected during this sampling event. Data gathered during the sampling event will be consolidated and compiled into a database that can be used to evaluate site conditions and data trends. The data management plan will serve as a guide for all database users. The plan is subject to revision to allow the database management system to be modified as it is developed and maintained. The plan describes the following:

- The responsibilities of the project team for data management
- The data management system to be established for the project
- The development of the base maps onto which the data will be plotted
- The types of data to be entered into the data management system and the process of data entry

### 2.12.1 Team Organization and Responsibilities

Team members and their responsibilities for the data management process are described in Section 1.1 and as follows:

**Commented [SJ160]:** Mark Loomis: Sections 1.1, 2.12.1 – The roles and responsibilities for CH2M Database Manager Rick Dobbins and CH2M Geographic Information System and Mining Visualization System Analyst Mark Petershack are described in two places of the SAP: in Section 1.1 (Project Organization) and in Section 2.12.1 (Data Management Plan, Team Organization and Responsibilities). It's recommended that each of these sections reference the other so that any discrepancies in responsibilities between the sections are addressed.

**Commented [SJ161R160]:** Text revised

- The **project manager** and **project chemist** establish the sample tracking system.
- The **project chemist** does the following:
  - Tracks the chain-of-custody forms and other sampling information
  - Oversees proper use of the EPA Scribe software and accuracy of the information entered
  - Conducts tracking of samples, forwards tracking information and received data to the database manager, and identifies the data inputs (e.g., sample numbers) to use in generating tables and plots
  - Reviews incoming analytical laboratory deliverables for completeness to ensure that data are present and available for further review
  - Oversees or performs data verification and validation

- Coordinates independent validation with GLNPO and its contractor
- Completes a data usability report that summarizes the field data acceptability and validation findings

- The **database manager** is responsible for coordinating and overseeing a variety of data management tasks. The tasks include, but are not limited to, the following:
  - Setting up the data management system in consultation with the project chemist
  - Informing CH2M of missing or incorrect information in the EDD so that CH2M can work with the laboratory to address such issues
  - Uploading the field data and laboratory EDDs into the project database
  - Providing data conversion/manual entry into the database, QC of the entered data
  - Coordinating upload of the independent validation qualifiers to the project database
  - Providing cross-tab data tables for field and laboratory data
  - Preparing the EDDs for entry of study data into the EPA's GLSED
  - Forwarding all deliverables to the project chemist, project manager, or designee.
- The **GIS** and MVS analyst~~manager~~ is responsible for the following:
  - Coordinating with the project manager to set up a geodatabase before sampling
  - Maintaining spatial layers and overall geodatabase integrity and accuracy
  - Providing GIS- and MVS-related outputs for reports

### 2.12.2 Sample Tracking

The project chemist or designee will be responsible for tracking samples to ensure that the analytical results for all samples sent for analysis are received by the laboratory. Sample IDs, collection date, and analysis information from Scribe and the chain-of-custody forms will be used for tracking. Upon receiving a sample receipt notice from the laboratory, the project chemist will enter the date received by the laboratory and the date the deliverables are due. The project chemist will also enter the date of receipt of the data package and EDD. Upload of EDD files and entry of validation qualifiers will be tracked in the sample tracking table.

### 2.12.3 Data Types

Activities at the site will involve accessing the types of data collected to confirm whether project objectives were met.

Data collected during this event will be used as it becomes available to create a project database. The database will include field and laboratory data reviewed by CH2M and the independent validator. The data source will be noted in the database. Procedures for incorporating data into the database are presented in subsequent sections of the data management plan.

### 2.12.4 Data Management

#### 2.12.4.1 Hard Copy

Measurements made during field data collection will be recorded in field logbooks or field forms. Field data will be reduced and summarized, tabulated, and stored along with the field logbooks. All raw analytical laboratory data will be stored as an original hard copy. Hard copy information includes chain-of-custody forms, analytical bench sheets, instrument printouts and chromatograms, certificates of analyses, and QA/QC report summaries. Validation reports will be stored with the data package reports.

#### 2.12.4.2 Data Input Procedures

Sampling information, analytical results, applicable QA/QC data, data validation qualifiers, and other field-related information will be entered into the project database for storage and retrieval during data evaluation and report development. The analytical data will be loaded into the database using EDD files received from the analytical laboratory. Validation qualifiers will be entered into the database through an electronic data validation tool, EQuIS 6 Data Qualification Module (see Section 4.3.2).

Other available field-related data collected will be manually entered onto Scribe for loading into the project database. The entry of other field-related data will be confirmed by comparing exports from the database against the original files used to perform the data entry. All data entry confirmation procedures and results will be documented.

### 2.12.5 Computer Database

The technical data including sample location information, laboratory analytical results, and analytical data validation will be managed using EQuIS 6, a third-party database system by EarthSoft, that is used to store and analyze project data submissions. The core EQuIS applications are its chemistry and geology modules, each of which is associated with its own underlying Microsoft SQL Server database. CH2M owns licenses for the geology and chemistry modules. The EQuIS database system is based on a relational model in which independent tables, each containing a certain type or entity of data, can be linked through selected fields that are common to two or more tables. The database design allows for the inclusion of historical data and allows users to effectively conduct trend analysis and generate a variety of data reports to aid in data interpretation.

The field data in Scribe and the laboratory submittal will be evaluated for completeness and compliance. Once it is determined that the data are complete and finalized, they will be imported into the project database. Field and laboratory data will be merged and each record evaluated for successful and complete merging.

The database will be protected from unauthorized access, tampering, accidental deletions or additions, and data or program loss that can result from power outages or hardware failure. The following procedures will be adopted to ensure protection:

- The master database will be stored hosted by EarthSoft on a network file server with Web access from a local to the installation of the EQuIS data management system and access via EQuIS Enterprise Web interface. Members of the data management team involved in loading, modifying, or querying the database will be given access through EQuIS user accounts and passwords, as well as the appropriate network server permissions.
- EQuIS Enterprise provides users with a Web-based interface that allows for data reporting in standard formats. Where required, data exports from copies of the master database will be stored on the local area network for access by project staff through custom reporting tools developed to

minimize possible database corruption by users. Whenever the master database is updated or modified, the data will be recopied exported to the local area network to ensure that the current copy data set is available to users.

- Daily backups of the master database and its copies will be made to ensure that the data will not be lost due to problems with the network. Each night a daily differential backup will be performed by EarthSoft. Then, each week a full backup will be completed by EarthSoft. The backups are stored on a storage area network device located in Utah, and are then transferred to an offsite data center.

### 2.12.6 Geographic Information System and 3-D Analytical Modeling

Workflow for creating, maintaining, and organizing geospatial data will follow the spatial data standard format for projects whenever possible.

An ArcView project or extension will be used providing the following functionality: load and display project site base maps; display sampling station locations and associated sampling data (date, media, results); and perform ad hoc queries to highlight sampling locations meeting user-entered criteria for sampling (such as data by date, sample type, analyte, depth/elevation, result value, or any combination thereof).

### 2.12.7 Documentation

Documentation of data management activities is critical because it provides the following:

- A hard copy record of project data management activities
- Reference information critical for database users
- Evidence that the activities have been properly planned, executed, and verified
- Continuity of data management operations when personnel changes occur

The data management plan is the initial general documentation of the project data management efforts. Additional documentation will be maintained to document specific issues, such as database structure definitions, database inventories, database maintenance, user requests, database issues and problems, and client contact.

### 2.12.8 Project Record File

The final project record file will be the central repository for documents that constitute evidence relevant to sampling and analysis activities. CH2M will be the custodian of the file and will maintain the contents of the file for the project, including relevant records, reports, logs, field notebooks, pictures, contractor reports, and data reviews, in a secured area with limited access during the project duration.

CH2M will keep records until project completion and closeout at which time the project data contained within the project record file will be transferred to EPA.

As necessary prior to closeout, records may be transferred to a records storage facility. The records storage facility must provide secure, controlled-access records storage.

Records of raw analytical laboratory data, QA data, and reports will be kept by the subcontract laboratory for at least 5 years.

### 2.12.9 Presentation Investigation Data

Depending on the data user's needs, data presentation may consist of any of the following formats:

- Tabulated results of data summaries or raw data
- Figures showing bathymetry, topography, or location-specific results

Other types of data elements may be added as the field investigation needs and activities evolve.

# Assessment and Oversight

## 3.1 Assessments and Response Actions

Field and laboratory activities will be assessed for technical and procedural compliance with this SAP. Performance and system audits are key factors for verifying compliance. The following are the purposes of the audits:

- Confirm that appropriate documents are properly completed and kept current and organized
- Ensure measurement systems are accurate
- Identify nonconformance or deficiencies and initiate necessary corrective actions
- Verify that field and laboratory QA procedures called for are properly followed and executed

The CH2M project manager, CH2M QAM, and the laboratory QAM are responsible for ensuring conformance with SOPs. Activities selected for audit will be evaluated against specified requirements, and the audit will include evaluation of the method, procedures, and instructions. Documents and records will be examined as necessary to evaluate whether the QA program is effective and properly implemented. Reports and recommendations must be prepared on all audits and submitted to the CH2M QAM for retention in the project files.

The CH2M project manager is responsible for overseeing all CH2M project personnel and ensuring that staff members follow proper protocol for field activities, project support activities, and the execution of the project-related tasks. The CH2M project manager will assign qualified personnel to conduct specific project activities appropriate to their qualifications. The CH2M project manager will request regular feedback from lower-level management personnel and individuals directly involved with project activities to gauge effectiveness. The CH2M project manager is responsible for implementing all corrective activities as needed on this project.

The laboratory project manager is responsible for coordinating and scheduling the laboratory analyses, supervising the in-house chain of custody, accepting requirements outlined within the SAP, overseeing data review, and ensuring that the laboratory QA requirements are met and that laboratory QA procedures are properly followed, and analytical reports are correctly prepared.

### 3.1.1 Field Audits

Planning, scheduling, and conducting QA audits and surveillance are required to verify that site activities are being performed efficiently in conformance with approved plans, standards, federal and state regulatory requirements, sound scientific practices, and contractual requirements. Planned and scheduled audits may be performed to verify compliance with aspects of the QA program and to evaluate the effectiveness of the QA program. Audits include the following:

- Objective examination of work areas, activities, and processes
- Review of documents and records
- Interviews with project personnel
- Review of plans and standards

The field team leader will conduct a daily internal review of the sampling program during the project and will pay particular attention to the sampling program with respect to representativeness, comparability, and completeness of the specific measurement parameters involved. Problems identified through the review will be documented in the logbook and appropriate corrective actions implemented. The field team leader or a designee will review field documentation (chain-of-custody forms, field daily sheets, and logbooks) daily for accuracy, completeness, and compliance with SAP requirements. The field team leader will also audit field sampling procedures for compliance with SAP procedures to check for the following:

- Sampling protocols are followed.
- Samples are placed in proper containers.
- Samples are stored and transported properly.
- Field documentation is completed.

EPA may also perform scheduled or non-scheduled field audits during sampling activities.

#### 3.1.1.1 Field Corrective Action

Any project team member may initiate a field corrective action process, which consists of identifying a problem, acting to eliminate it, monitoring the effectiveness of the corrective action, verifying that the problem has been eliminated, and documenting the corrective action in the logbook.

Corrective actions include correcting chain-of-custody forms; addressing problems associated with sample collection, packaging, shipping, and field record keeping; and providing additional training in sampling and analysis. Additional approaches may include resampling or evaluating and amending sampling procedures. The field team leader will summarize the problem, establish possible causes, and designate the person responsible for a corrective action. The field team leader will verify that the initial action has been taken and appears effective and will follow up to verify that the problem has been resolved.

Technical staff and project personnel will be responsible for reporting suspected technical or QA nonconformance or suspected deficiencies to the field team leader, who will be responsible for assessing suspected problems in consultation with the CH2M QAM, laboratory QAM, and the CH2M project manager. Based on the situation's potential to affect data quality, the project manager will notify the COTR to discuss the issue before a decision is made. If a reportable nonconformance is found to require corrective action, the field team leader will initiate a nonconformance report and submit it to the CH2M project manager.

The field team leader will be responsible for ensuring that corrective actions for nonconformance are initiated by the following method:

- Evaluating reported nonconformance
- Controlling additional work on nonconforming items
- Determining disposition or action to be taken
- Maintaining a log of nonconformance
- Reviewing nonconformance reports and corrective actions taken
- Ensuring that nonconformance reports and corrective actions are replayed to the CH2M management team and documented in the project files

### 3.1.2 Laboratory Quality Assurance Program

The laboratory will maintain a quality assurance manual or equivalent document. The QAM will define the laboratory's internal procedures for QA/QC as follows:

- QA policies, objectives, and requirements
- Organization and personnel
- Document control
- SOPs (analytical methodology and administrative)
- Data generation

- Software verification
- QA
- QC
- Nonconformance/corrective action procedures
- Data review

### 3.1.3 Laboratory Audits

The laboratory QAM may conduct internal system audits, which are qualitative evaluations of all components of the laboratory QC measurement system. The audit will serve to determine whether all measurement systems were used appropriately. System audits will be conducted to evaluate the following:

- Sample handling procedures
- Calibration procedures
- Analytical procedures
- QC results
- Safety procedures
- Record keeping procedures
- Timeliness of analysis and reporting

Laboratories also may be subject to external audits, which focus on assessing general laboratory practices and conformance to this SAP. Laboratory audits may be performed before the analyses begin and at any time during the course of the project, as deemed appropriate.

The laboratory QAM will review internal laboratory performance. The laboratory QAM will evaluate laboratory precision and accuracy by comparing the results of duplicate samples, QC samples, spikes, and blanks. The laboratory QAM or other client services individual will check the analytical results prior to distribution when a beyond-control-limit situation is encountered.

External laboratory performance reviews may be conducted based on evaluation of the results of check samples analyzed as part of EPA or state certification requirements. They also may be conducted by sending "double-blind" performance evaluation samples (those not discernible from routine field samples) to the analytical laboratory. EPA GLNPO may conduct external audits.

#### 3.1.3.1 Laboratory Corrective Action

Corrective actions may be required for analytical/equipment problems or for noncompliance problems. Analytical/equipment problems may occur during sampling, sample handling, sample preparation, laboratory instrumental analysis, or data review.

A corrective action program will be determined and implemented when a noncompliance problem is identified. The person identifying the problem will be responsible for notifying the proper project member. If the problem is analytical in nature, information on the problem will be communicated to the laboratory QAM and the CH2M project chemist, who will in turn direct information to proper project members. Implementation of corrective actions will be confirmed through similar channels.

Corrective actions will be documented. No staff member will initiate a corrective action without prior communication about the action that needs correction and the proposed corrective action through the proper channels. If corrective actions are insufficient, the CH2M project manager or the CH2M QAM may issue a stop work order.

Corrective actions are required whenever an actual or potential out-of-control situation is noted. The investigative action taken depends somewhat on the analysis and the event. Laboratory personnel are alerted that corrective actions may be necessary if the following are found:

- QC data are outside the warning or acceptable windows for precision and accuracy.
- Blanks contain target analytes above acceptable levels.
- Undesirable trends are detected in spike recoveries or RPD between duplicates.
- Unusual changes in detection limits occur.
- Inquiries concerning data quality are received.
- Deficiencies are detected by the laboratory QAM during internal or external audits or from results of performance evaluation samples.

Corrective action procedures are often handled at the bench level by the analyst. The analyst will review preparation or extraction procedures for possible errors and check instrument calibrations, spike and calibration mixes, and instrument sensitivity. If problems persist or cannot be identified, matters will be referred to the laboratory supervisor, laboratory project manager, or laboratory QAM for further investigation. Once the issue is resolved, full documentation of the corrective action procedures will be filed with the CH2M QAM and laboratory QAM after approval by CH2M. Corrective actions may include the following:

- Resampling and analyzing
- Evaluating and amending sampling procedures
- Evaluating and amending analytical procedures
- Accepting data and acknowledging the level of uncertainty
- Reanalyzing the samples, if sample or extract volume is adequate and holding-time criteria permit

If resampling is necessary because of laboratory problems, the CH2M project manager must identify the appropriate approach, including cost recovery from the laboratory for the additional sampling effort.

#### 3.1.3.2 Laboratory Standard Operating Procedures

The laboratory will maintain SOPs for all analytical methods and laboratory operations. The format for the procedures will conform to the following references:

- *Test Methods for Evaluating Solid Waste, Physical and Chemical Methods* (EPA, 2008)
- "Good Laboratory Practices" in *Principles and Guidance to Regulations for Ensuring Data Integrity in Automated Laboratory Operations* (EPA, 1995)

All SOPs must have a unique identification number that is traceable to previous revisions of the same document.

#### 3.1.3.3 Demonstration of Capability

Personnel in the laboratory QA department will maintain records documenting the ability of each analyst to perform applicable method protocols. Documentation will include annual checks for each method and analyst. Internal, blind performance evaluation samples for each method and matrix demonstrating overall laboratory performance must be submitted annually. The laboratory may receive additional blind performance evaluation samples in conjunction with the program.

### 3.1.4 Corrective Action

Corrective action may be required as a result of deviations from field or analytical procedures. Deficiencies identified in audits and data quality evaluations may also call for corrective action. All project personnel have the responsibility, as part of their normal work duties, to identify, report, and solicit approval of corrective actions for conditions adverse to data quality.

Field and laboratory staff may encounter conditions that require immediate corrective action. Personnel will document conditions and the results of corrective actions in a field logbook or laboratory nonconformance report and communicate their actions as soon as possible to the field team leader, laboratory supervisor, and if necessary, the project chemist for immediate input. The Corrective Action Preventive Action system is in place to allow for supervisory review or client input for all deviations or deficiencies. The corrective action reporting system requires immediate documentation of deviations or deficiencies and for supervisory review of the actions taken to correct them. At a minimum, the corrective action report should include the following:

- Type of deviation or deficiency
- Date of occurrence
- Impact of the deviation or deficiency, such as samples affected
- Corrective action taken
- Documentation that the process has been returned to control

The only time a corrective action report may be waived is when a deviation or deficiency is immediately corrected, and its impact is precluded. An example would be an unacceptable initial calibration that is repeated before samples are analyzed.

A core program or project team member can initiate a corrective action preventive action but will consult with the CH2M QAM prior to submittal. The CH2M QAM will be responsible for reviewing corrective action preventive actions, assigning them to the appropriate action owners, and monitoring completion of both short- and long-term actions. The ultimate responsibility for the laboratory corrective action process is the laboratory QAM, who must ensure that proper documentation, approval, and closeout of all out-of-control or nonconformance events are performed. A nonconformance report will summarize each nonconformance condition. Corrective action reports that could affect data quality must be brought to the attention of the project chemist. Report disposition will be the responsibility of the project chemist. The CH2M project manager may be notified about a particular report at the project chemist's discretion. Copies of corrective action reports must be maintained in the laboratory or field project files and will be submitted with the associated data package.

## 3.2 Reports to Management

In addition to audit reports submitted to the CH2M project manager in accordance with the SAP, a monthly progress report will be prepared by the CH2M project manager and submitted to the COTR.

After the sample results received from the laboratory are evaluated, reduced, and tabulated, and the results of the independent validation are received, a data evaluation package documenting the field investigation will be submitted to the COTR. The data evaluation package will include an electronic file containing the final laboratory and field data, including coordinates and copies of field notes and sampling logs, and raw laboratory data.

# Data Validation and Usability

## 4.1 Field and Laboratory Data Management

Data will be reduced manually or by using appropriate application software. Quantitation procedures specified for each method must be followed. If data are reduced manually, the documentation must include the formulas used. Any application software used for data reduction must have been previously verified by the laboratory for accuracy. Documentation of the software's verification must be maintained on file in the laboratory. Documentation of data reduction must allow re-creation of the calculations.

All chemical analytical data will undergo at least four levels of review at the laboratory before release. The following four steps will be followed:

- The analyst performing the tests initially will review 100 percent of the data to check for the following:
  - Sample preparation information is correct and complete.
  - Sample analysis information is correct and complete.
  - Appropriate analytical procedures were followed.
  - Analytical results and reporting units are correct and complete.
  - QC samples are within established control limits or qualified when outside limits.
  - Documentation is complete.
- The senior analyst or the section supervisor will review 100 percent of the data for the following:
  - Accuracy and compliance with calibration and QC requirements, holding-time compliance, and completeness
  - Verification of analyte identification and quantitation
  - Comparison of calibration and QC results with the applicable control limits
  - Review of reporting limits to see that they meet the project objectives
- The laboratory QAM will review at least 10 percent of data or deliverables generated for the program against the project-specific requirements.
- The laboratory manager or client services representative will conduct a final data review to check that all required analyses were performed on all samples and that all documentation is complete.

Data will be generated in the field during sample collection and in the laboratory during sample analysis. CH2M is ultimately responsible for overseeing data management for the project both in the field and in the laboratory.

In support of data review, verification, and validation, a suite of procedures has been established and includes the following:

- Field data will be recorded and reported using Scribe. Scribe export files for the project field data will be submitted to the database manager for review and will be incorporated into the project database. The database manager will review the files for completeness, and the CH2M project chemist will check compliance with the SAP and the GLLA data reporting standard. Deviations and nonconformance issues will be documented and potential impact on sample results will be evaluated and detailed in the CH2M data validation report.

- Chemical analysis laboratories will submit the laboratory data in the EPA Region 5 EQuIS EDD format to the CH2M project chemist. Geotechnical analysis laboratories will submit laboratory test results in an excel format if able and/or in a PDF report.
- The laboratory and field data will be merged into a single database for the project.
- Chemical laboratory data will be checked for completeness and compliance, and will be reviewed, verified, and validated by CH2M. Geotechnical laboratory data will be checked for completeness and compliance.
- Usability of the project data will be evaluated by CH2M based on the data assessment findings and documented in the data usability report.
- At the direction of GLNPO, the data validation results will be provided for independent validation, and findings by the validator will be incorporated into the final data set.
- A final deliverable for GLSED will be submitted to EPA with the data usability report and the supporting data assessment documentation.

### 4.1.1 Laboratory Report Description

Hard copy deliverables (or PDF files), in summary format, provided by the subcontract laboratory will be consistent with the deliverable requirements using either contract laboratory program equivalent forms or internal laboratory standardized versions. The laboratory will provide a Level 4 data package for all analytical fractions as appropriate by method for this project. The laboratory data report should be organized in a consistent and logical format that facilitates data identification and retrieval.

Hard copy and electronic laboratory reports for all samples and analyses will contain the information necessary to perform data evaluation. Hard copy packages will be designed logically to permit the validator and other reviewers ease of access and ability to navigate the reported data. Geotechnical data provided in an electronic format along with a hard copy report package if available.

Results of multiple dilutions should be reviewed for consistency. The laboratory must resolve and correct discrepancies. Laboratory qualifiers will be applied when there is a condition of nonconformance that could potentially affect data usability. The qualifiers must be properly defined as part of the deliverables. Issues relevant to data quality must be addressed in a case narrative.

A **Level 1 report** will include at least the following information (when applicable):

- Cover letter complete with the following information:
  - Title of report and unique report identification (sample delivery group number)
  - Project name and site location
  - Name and location of laboratory and second-site or subcontracted laboratory
  - Client name and address
  - Statement of authenticity and official signature and title of person authorizing report release
- Table of contents
- Summary of samples received that correlates field sample IDs with the laboratory IDs
- Laboratory qualifier flags and definitions
- Field identification number
- Date received

- Date prepared
- Date analyzed (and time of analysis if the holding time is less than or equal to 48 hours)
- Preparation and analytical methods
- Result for each analyte (dry-weight basis for sediments)
- Percent solids results for sediment samples
- Dilution factor (provide both diluted and undiluted results when available)
- Sample-specific reporting limit adjusted for sample size, dilution/concentration
- Sample-specific MDL adjusted for sample size, dilution/concentration (when project objectives require reporting less than the reporting limit)
- Units

A **Level 2 report** will consist of all the elements included in a Level 1 deliverable, plus the following:

- Case narrative that addresses at least the following information:
  - Sample receipt discrepancies, such as bubbles in volatile organic analysis samples and temperature exceedances
  - Descriptions of all nonconformances in the sample receipt, handling, preparation, and analytical and reporting processes, and the corrective action taken in each occurrence
  - Identification and justification for sample dilution
- Surrogate percent recoveries
- MS/MSD and LCS spike concentrations, native sample results, spiked sample results, percent recoveries, RPDs between the MS and MSD results, and associated QC limits
- Method blank results
- Analytical batch reference number that cross-references samples to QC sample analyses
- Executed chain of custody and sample receipt checklist

A **Level 3 report** will consist of all the elements in Level 1 and Level 2 reports, plus the following:

- Analytical sequence or laboratory run log that contains sufficient information to correlate samples reported in the summary results to the associated method QC information, such as initial and continuing calibration analyses
- Confirmation results
- Internal standard recovery and retention time information, as applicable
- Initial calibration summary, including standard concentrations, RFs, average RFs, relative standard deviations or correlation coefficients, and calibration plots or equations, if applicable (required in hard copy format only)
- Continuing calibration verification summary, including expected and recovered concentrations and percent differences (required in hard copy format only)
- Instrument tuning and mass calibration information for gas chromatography[ eq \O(/, )]mass spectrometry and inductively coupled plasma/mass spectrometry analyses

- Any other method-specific QC sample results

A **Level 4 report** will include all elements outlined above for the Level 1 through Level 3 reports and all the associated raw data (see Table 9~~8~~). It is imperative that the relative scale used for chromatographic and other instrument data be supplied in a scale that facilitates review from hard copy. Complex areas of sample chromatograms will be sufficiently enlarged to facilitate viewing, and the enlargements will be provided. The following information also will be supplied:

- Sample preparation logs that include the following:
  - Preparation start and end times
  - Beginning and ending temperatures of water baths and digestion blocks
- Example calculation (and algorithm) for obtaining numerical results from at least one sample for each matrix analyzed
- Reconstructed ion chromatograms or selected ion current profiles for each sample (and blank) analyzed and mass spectra for each compound identified, including the following:
  - Raw compound spectra
  - Enhanced or background spectra
  - Laboratory-generated library spectra (for tentatively identified compounds provide the reference mass spectra from software spectra library)

## 4.2 Data Review, Verification, and Validation

Data validation is the process of reviewing project data against the data QA/QC requirements. The data are evaluated for precision and accuracy against the analytical protocol requirements stated in the laboratory scope of work. Nonconformance issues or deficiencies that could affect the reported result's precision or accuracy are identified and considered when assessing whether the result is sufficient to achieve DQOs.

The data collected as part of the field investigation must be consistent with this SAP. EPA National Functional Guidelines will be used as guidance on data validation procedures. QC requirements are as specified in the analytical methods, laboratory SOWs, and laboratory SOPs. QC requirements specified in the laboratory SOWs will take precedence over the functional guidelines requirements when listed.

The data are verified to assess whether the EDDs and the hard copy data deliverables are consistent with one another to ensure an accurate database. The data will be evaluated in such a way as to determine whether the results make sense if compared with anticipated results. If the data are consistent with anticipated results, no corrective action will be deemed necessary. However, if the data obtained from the laboratory are not consistent with the anticipated results, an in-depth evaluation of the results may be necessary to interpret the deviation.

Final laboratory data will be reviewed, verified, and validated by CH2M. One hundred percent of the chemical analysis (groundwater, effluent water, and elutriate water) laboratory data will follow Tier 1 validation and 20 percent will follow Tier 2 validation level according to *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use* (EPA, 2009). The results for geotechnical parameters will be verified by the laboratory and will be reviewed for completeness and usability by CH2M. Geotechnical results and waste characterization data will not undergo data verification or validation. Data qualifiers will be applied to specific sample results when there are nonconformances that could potentially affect data usability. Data review findings will be documented using data qualifiers in the EDD and in validation narratives. The project chemist will evaluate and assess how the data, as qualified, can be used for the project.

### 4.2.1 Independent Review

At the direction of GLNPO, ~~CH2M will provide the validated data set to~~ a third-party validator is not required to review CH2M's validated data for this sampling event~~, under contract to GLNPO, for an independent review of the validation. The information submitted for the review will include the electronic laboratory data packages, SAP, laboratory SOPs, laboratory EDD files, and 100 percent of the validated data in a Microsoft Excel template or other approved electronic format. The third-party validator will provide a data validation narrative and EDDs. CH2M will review and incorporate the findings of the independent validator into the final data set.~~

**Commented [SJ162]:** Section 4.2.1 – The percentage and level of third party data validation is not specified in SAP Section 4.2.1. Typically, Tier 1 validation is required for 100% of the sample results, and Tier 2 validation is specified for 20% of the results. Note that some projects require 100% Tier 2 validation for select parameters.

**Commented [EJ163R162]:** Julie: Text added, but EPA needs to tell us what they would want a 3rd party validator to validate and at what level.

**Commented [SJ164R162]:** 10-7-19 call: Mary Beth asked Julie to send her email with this question so she could discuss with Mark Loomis.

**Commented [SJ165R162]:** Julie sent email on 10-8-19

**Commented [EJ166R162]:** Updated with no independent validation per Mark Loomis email

## 4.3 Validation and Verification Methods

Data validation is conducted to assess the effect of the overall sampling and analysis process on the usability of data. There are two areas of review: laboratory performance evaluation, and the effect of matrix and sampling interference. The laboratory performance evaluation is a check for compliance with the method requirements. The laboratory either did or did not analyze the samples within the QC limits of the analytical method and according to protocol requirements. Potential matrix and sampling effects are assessed by a QC evaluation of the analytical results and by an examination of the results of testing blank, duplicate, and MS samples; and then by determining how, if at all, it could affect the usability of the data.

The analytical data will be supported by a data package. The data package will contain the supporting QC data for the associated field samples. (See Section 4.1.1 for the data package content requirements.) Before the laboratory will release each data package, the laboratory QAM (or the analytical section supervisor) must carefully review the sample and laboratory performance QC data to verify sample identity, the completeness and accuracy of the sample and QC data, and compliance with method specifications.

The verification/validation process will be performed by a combination of electronic and manual methods.

The CH2M project chemist will use manual validation following the National Functional Guidelines to validate analytical data based on the parameters set by the chemist and database manager in the SAP. Data flags, as well as the reason for each flag, are entered into an electronic database and made available to the data users.

If, during the data review and verification process, a systematic problem or other issue with the dataset is identified, the CH2M project chemist will contact the laboratory's project manager or QA manager. Additional evaluation of the data may be performed including an in-depth review of the raw data to verify accuracy followed by analysis and interpretation of the data in the context of the project objectives and end-use as part of the usability assessment.

A data validation report will be prepared summarizing the findings and discussing their impact on the overall data usability. It will be incorporated into the final data usability report.

### 4.3.1 Field Data

Scribe will be used to generate sample numbers, labels, and chain-of-custody forms. Field records will be generated in hard copy field logs and included as an appendix to the final data summary. The field data to be incorporated in the project database will be entered into Scribe by CH2M team members. The CH2M project chemist or field team leader will forward the complete field database file to the CH2M data manager who will import the field data into the project database.

The field data will be assessed for completeness, compliance, and accuracy in accordance with the requirements stated in this SAP. The data entry in electronic files will be checked by comparing hard copy data contained in the logbooks or forms to a printout of the electronic file. Data entry confirmation procedures and results will be documented.

### 4.3.2 Laboratory Data

The subcontract laboratories will generate chemical analytical data supporting the project. Data will be generated and managed at the laboratories according to the laboratory SOPs (Appendix B~~A~~). As detailed in the laboratory SOW, all analytical data are to be checked and reviewed at the laboratory by the analyst generating the data and an experienced data reviewer before being released to CH2M.

Discrepancies must be resolved and corrected at the time of discovery. Laboratory qualifiers will be applied when there is nonconformance that could potentially affect data usability. The laboratory qualifiers will be defined as part of the deliverables. Issues relevant to the quality of the data will be addressed in the laboratory case narrative.

Analytical results will be submitted as an EDD and will be accompanied by an analytical report in an electronic (PDF) format. SDG data reports will be generated by the laboratories consistent with the formats identified in the laboratory SOWs.

For the data package, each analytical report must contain the information specified in the SOW and a case narrative that includes, but is not limited to, the following information:

- Sample summary, cross referencing the field and laboratory sample identification, matrix, the date that the sample was collected in the field, and the date the laboratory received the sample
- Project summary referencing the analytical methodology
- Discussion of protocol deviations that may have occurred during sample testing
- Discussion of QC sample questions encountered and the corrective measures taken
- Summary and discussion of samples that were diluted by the presence of an interference or target analyte

For electronic data submittal, laboratories will report analytical data in the EPA Region 5 EQuIS EDD format. Data packages (EDD and narrative) and full reports (PDF files) will be provided to CH2M.

Following receipt of the data package, CH2M will perform completeness and compliance checks with the laboratory SOWs. CH2M will validate the laboratory reports and EDD files using the EQuIS 6 database system. A project-specific library will be completed based on the requirements in this SAP. Data qualifiers associated with the validation checks will be applied to specific sample results and input into the project database. Findings of the data validation will be documented in the data usability report.

## 4.4 Reconciliation with Data Quality Objectives

The final activity of the data validation process is to assess whether the data fulfill the objectives for the project. The project chemist will check final results, as adjusted for the findings of any data validation/data evaluation, against the DQOs. The data acquired from the RD investigation should fulfill the project objectives.

The CH2M project manager or designee will evaluate investigation results to assess whether the project objectives have been met. The objectives will be met if all scheduled samples and data readings documented in the SAP are obtained and all data are deemed usable after sufficient validation and evaluation. If the objectives are not met, the reasons for not meeting them will be identified and examined to determine data insufficiency. A corrective action will be implemented.

# General Field Operations

This section describes general field operations and procedures to be executed to ensure the safety of personnel onsite during field activities, as well as the quality of field data collection and field documentation.

## 5.1 Health and Safety Plan

CH2M staff and entities directly subcontracted to CH2M will abide by U.S. Occupational Safety and Health Administration regulations and the site-specific HASP. General topics covered in the HASP include site location and scope of work, safety and health risk analysis, field team organization and responsibilities, PPE, site control measures, decontamination procedures, emergency response plan, employee training, and medical monitoring. The HASP will be kept onsite during field activities, and a copy will be maintained in the project files.

## 5.2 Field Data Documentation Procedures

Consistent procedures will be implemented by CH2M to document the location, media, and the physical parameters collected in the field. The procedures include recording the sample location information, photographs, maintaining a file of parameter data generated as a result of field activities, and recording field sampling location survey data. Field notes at each location may include the following information (if applicable): date, time, personnel, weather conditions, station identification, *x,y* coordinates, *z* elevations (top of water, top of sediment), water depth, core penetration depth, sediment recovery thickness, and media descriptions. The following subsections describe the documentation methods that will be used.

### 5.2.1 Field Logbook

A field logbook will be initiated at the start of the first onsite activity and maintained to document field activities throughout the field effort in accordance with FOP-11, Field Logbook.

### 5.2.2 Field Forms

Standard forms may be used in addition to the field logbooks to ensure that necessary data are recorded consistently and provide a more detailed record of field data. No blank spaces will appear on completed forms. If information requested is not applicable, the space will be marked with a dashed line or marked "N/A." The forms are to be completed in the field and placed in the project files. Field forms will provide information necessary to document sample location ID, sediment core descriptions and measurements, survey information (*x, y* coordinates and *z* elevations), observations (for example, staining or odor), and IDW tracking information. Field forms to be implemented by CH2M for this project include Sediment Core Logs, Boring Logs, Calibration Logs, Well Installation Logs, GIS Metadata Forms, and an IDW Tracking Form (included as attachments to the FOPs in Appendix B).

### 5.2.3 Photographic Documentation

The CH2M field team leader or designee will selectively photograph field activities and field conditions to complement descriptions of field activities in the field logbook. The following information will be recorded in the logbook when photographs are taken:

- Date and time
- Location and compass direction of the photograph

- Description and identification of the subject
- The initials of the person who took the photograph

CH2M will maintain digital picture files for reference during the project.

## 5.3 Field Data Quality Control Procedures

Information collected in the field through visual observation, manual measurement, and/or field instrumentation will be recorded in field logbooks and/or on data forms. The field team leader will review the data for consistency and adherence to this QAPP. Concerns identified will be corrected and incorporated into the data evaluation process.

Field data calculations, transfers, and interpretations conducted by the field team will also be reviewed by the CH2M field team leader. Original field documents will be kept in the project file.

Field documents will be checked for the following:

- General completeness
- Readability
- Clearly stated use of appropriate procedures and modifications to probing and sediment sampling procedures
- Appropriate instrument calibration and maintenance records (as appropriate)
- Reasonableness of data collected
- Correctness of sample locations
- Correctness of reporting units, calculations, and interpretations

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Tables

Table 1. Cross-Walk between Design Element and Field Activity
*Cuyahoga River Gorge Dam, Cuyahoga Falls, Ohio*

| Design Element | Defined Data Gap | How to Fill Data Gap | Field Activity |
|---|---|---|---|
| Geotechnical— Sediment Removal/Disposal | Slope stability evaluation | SPT, geotechnical Llaboratory index, and strength testing | Geotechnical drilling |
| | Foundation design parameters for stability and settlement (e.g., prevent geotextile bag roll) | CPT with dilatometer testing, SPT, and geotechnical laboratory strength and consolidation testing | Geotechnical drilling/CPT |
| | Disposal site characterization for material reuse (e.g., containment berms) | Split-spoon sampling for geotechnical laboratory index testing and bulk sampling for compaction and permeability testing | Geotechnical drilling |
| | Groundwater (porewater) loading evaluation within Chuckery Area | CPT soundings with pore pressure dissipation tests. | CPT |
| | Existing groundwater characterization within Chuckery Area | Install temporary piezometers, sample groundwater for PAHs, specific total metals, and TSS. Monitor groundwater elevations monthly for 1 year | Piezometer installation, groundwater sampling |
| | Identification of borrow sources | Perform desktop study to identify potential borrow sources to support disposal area design needs. The study will include systematic review of potential borrow sources near the area, using stakeholder input, soil surveys, aerial photography (Google Earth/Environmental Systems Research Institute Geographic Information System [ESRI GIS]) to identify potential parcels, and review of electronic County records, and local or regional borrow sources. | None required |
| Infiltration | Groundwater conditions and soil permeability within the Chuckery Area disposal site | CPT soundings with pore pressure dissipation tests, geotechnical borings with Shelby tube sampling and laboratory in situ permeability testing. Install piezometers and monitor groundwater elevations monthly for 1 year. | Geotechnical drilling, piezometer installation, groundwater sampling |
| Boundary Survey | Project site area calculations for stormwater retention/treatment/dewatering and equipment laydown | Preform topographic survey of disposal area. | Topographic survey |
| Sediment RemovalCharacterization and Obstructions | Multi-beam bathymetry debris side-scan sonar. | Bathymetric survey to generate baseline conditions within the estimated sediment removal limits using side-scan sonar and multi-beam. | Bathymetric survey |
| Dredging Piping Route Evaluation | Pipe route mapping | Preform topographic survey of pipeline route. | Topographic survey |

Table 1. Cross-Walk between Design Element and Field Activity

*Cuyahoga River Gorge Dam, Cuyahoga Falls, Ohio*

| Design Element | Defined Data Gap | How to Fill Data Gap | Field Activity |
|---|---|---|---|
| Dewatering Bench-scale Testing | Elutriate, treatability, and stabilization analysis | Collect sediment core and bulk samples for index, polymer, settling, and geotextile weep testing. | Perform sediment sampling and sediment index and dewatering testing |
| Effluent Water Treatment | Treatment limits and discharge location determination | Treatment limits determined by treatability testing; discharge locations determined by site layout as evaluated from topographic survey results. | Perform sediment sampling and sediment testing; topographic survey. |
| Pool Lowering Evaluation (Alternative) | Pumping determination | Perform feasibility study, including calculations and preliminary design in demonstration of approach. | None ~~subcontractor~~ required |
| Pneumatic Flow Tube Mixing Dewatering Method | Treatability and stabilization analysis | Perform bench-scale testing. Analytical testing to include leaching, strength, and polymer/additive index properties. | Perform sediment sampling and sediment testing |

**Table 21. Data Quality Objectives for Sediment and Soil Sampling and Piezometer Installation**

*Cuyahoga River Gorge Dam GLLA Project, Cuyahoga Falls, Ohio*

| State the Problem | Goal of the Study | Information Inputs | Study Boundaries | Analytic Approach | Performance or Acceptance Criteria | Plan for Obtaining Data |
|---|---|---|---|---|---|---|
| ***Gorge Dam Pool Area*** | | | | | | |
| The data in this study are being collected to fill data gaps in support of the RD for the Cuyahoga River Gorge Dam Decommissioning project. Specifically, this evaluation is being conducted to define the physical characteristics of the sediments and treatability testing in portions of the Cuyahoga River Gorge Dam pool area. | The purpose of the sediment sampling activities is to collect physical and treatability data of the sediments within sections of the Gorge River that have defined data gaps.<br>The objective of the field sampling and laboratory analyses are to obtain the following data:<br>• Physical properties of the sediment, including thickness<br>• Determine current top of sediment elevation and calculate new sediment volumes for the design.<br>• Sediment characteristics needed to design of a geotextile tube dewatering system and temporary water treatment system by performing coagulant/polymer treatability testing | Existing Data: Sediment results from previous investigations (Battelle, 2012)<br>New Data: Sediment cores will be collected and visually characterized for sediment type, particle size, color, moisture, and consistency.<br>New Data: Samples will be collected as described under the column Plan for Obtaining Data and submitted for laboratory analysis for one or more of the following:<br>• Geotechnical properties of the composited sediment to look for variability within dam pool area<br>• Waste characterization samples: TCLP for total VOCs, SVOCs, pesticides, herbicides, metals; PCB Aroclors, pH, and flash point<br>• Composited treatability -samples: polymer and coagulate combinations (coagulants/settling agents, cationic, anionic polymers, non-ionic polymers), and water treatment additives such as ferric chloride, ferric sulfate, separation and performance consistency (qualitative and quantitative testing)<br>• Composited treatability samples: Each of the eight composited samples will be treated with the recommended polymer and polymer aid, if necessary, and shall be subjected to Geotube® rapid dewater test (RDT).<br>• Following the RDT testing, each of the eight composited samples will be treated with the recommended polymer and polymer aid, if necessary, and shall further be subjected the Geotube® Dewatering Test (GDT) for field-scale evaluation (replacing the former Hanging Bag Test).<br>• Treatability test samples (pretreatment elutriate and treated water): VOCs, SVOCs, pesticides, total and dissolved RCRA metals Hg, total suspended solids, pH, and alkalinity<br>Additional field data collection for sample locations: coordinates and elevations, water depth and elevation, core penetration, and recovery.<br>Sediment cores will be collected and composited for, particle size, color, moisture, consistency, as well as odors and staining.<br>Sample information: chain of custody, unique sample identification (ID), date, and time.<br>New Data: Bathymetry mapping to provide an *x,y,z* reference datum for the data being collected. | The Cuyahoga River Gorge Dam Pool sediments site is located upstream of the Gorge River Dam in Cuyahoga Falls, Ohio.<br>Samples will be collected from the Gorge River sediments site from the area immediately upstream of the dam and continuing upstream approximately 1.5 miles.<br>See Figure 43.<br>The sampling is expected to be conducted on the fall of 2019 and take approximately 7 days to complete. | The bathymetric survey will measure the top of sediment surface while the river bed surface features such as structures, debris, and utilities as well as surface substrate type characteristics will be located using a side scan sonar survey. A magnetometer survey will be conducted to locate underwater metallic objects such as utilities and metallic debris.<br>The results of the composited sediment geotechnical characteristics, waste characterization and treatability testing will be summarized and presented in the field site sampling technical memorandum. | Performance criteria for analytical chemistry data are established within the EPA-approved methods and laboratory SOPs.<br>Most potential decision errors typically will be associated with field sample variability and sample collection procedures. Analytical error usually is a much smaller portion of the total error associated with an environmental measurement.<br>Location information will be obtained using a submeter Trimble Pathfinder GPS. Location data will be in latitude/longitude (decimal degrees) World Geodetic System 1984. Elevation data will be obtained using 2019 survey data.<br>Water surface elevation from staff gauge will be measured to the nearest 0.1 foot..<br>Water depth will be measured to the nearest 0.1 foot from the water surface to the top of sediment.<br>Core penetration thickness measurements will be collected to the nearest 0.1 foot. The water depth will be subtracted from the overall penetration depth to determine sediment core penetration thickness.<br>Sediment core recovery measurements will be collected to the nearest 0.1 foot and compared to respective sediment core penetration thickness measurements to determine the percent of recovery.<br>Probed sediment thickness measurements will be collected to the nearest 0.1 foot. The water depth will be subtracted from the probe refusal depths to determine the sediment thickness. The multi-beam bathymetric survey will be conducted at 2-centimeter | At each of the 16 proposed sample locations, the following data will be collected:<br>• Install and survey staff gauge for determination of water surface elevation.<br>• Water depth will be measured using either a surveyor's rod with a 6-inch diameter disc attached or a surveyor's tape measure outfitted with a sounding disc or bell anchor 6 inches in diameter and weighing between 7 and 8 pounds, following Appendix B of the U.S. Army Corps of Engineers (USACE) Hydrographic Surveying Manual (USACE 2013).<br>• Probed sediment thickness will be measured by manually pushing a 0.75-inch diameter steel pole into the sediment until refusal. Refusal is defined as the depth at which penetration of the manual probe through the sediment layer is less than 0.1 foot after continuous pushing of the probe.<br>• Location ID and survey information (*x, y,* and *z* coordinates) for each location<br>• Cores will be collected through sediment column. Eight composite samples will be created from the 16- core locations<br>Eight composite samples will be created to conduct geotechnical and coagulant/polymer and dewatering treatability testing. Locations for treatability testing will be collocated with locations for visual classification and/or analysis, resulting in no additional sample locations. Bulk water will also be collected at each bulk sediment location. Slurry samples of the bulk water and sediment will be collected for pretreatment testing.<br>10 gallons of sediment and 20 gallons of water are required for each composite sample for treatability testing.<br>5 gallons of sediment are required for each composite sample for geotechnical testing.<br>Field data will be documented on the field form for each location<br>Refer to Section 2 for additional details. |

**Commented [MG167]:** What about surveying?

**Commented [WD168R167]:** Included in the Chuckery area below

**Table 21. Data Quality Objectives for Sediment and Soil Sampling and Piezometer Installation**

*Cuyahoga River Gorge Dam GLLA Project, Cuyahoga Falls, Ohio*

| State the Problem | Goal of the Study | Information Inputs | Study Boundaries | Analytic Approach | Performance or Acceptance Criteria | Plan for Obtaining Data |
|---|---|---|---|---|---|---|
| | | | | | accuracy standards and be reported to the nearest 0.05 foot. | |
| ***Chuckery ~~Disposal~~ Area*** | | | | | | |
| The data in this study are being collected to fill data gaps in support of the RD for the Cuyahoga River Gorge Dam Decommissioning project. Specifically, this evaluation is being conducted to define the geotechnical characteristics of the Chuckery ~~Disposal~~ Area. | The purpose of the geotechnical sampling activities is to collect physical data of the subsurface across the Chuckery ~~Disposal~~ Area that have defined data gaps.<br>The objective of the field sampling and laboratory analyses are to obtain data to support foundation, settlement, and existing material reuse evaluations.<br>Obtain topographic surveys to support engineering design | Existing Data: Historical shallow boring logs from the City of Akron, 1984<br>New Data: Standard Penetration Test borings with split-spoon and Shelby tube sampling. Data obtained: "N" values for strength values (SPT-N values[a] and pocket penetrometer undrained shear strength values). Soil samples will be collected and visually characterized for soil type, particle size, color, moisture, consistency, as well as odors and staining.<br>New Data: Samples will be collected as described under Plan for Obtaining Data and submitted for laboratory analysis for one or more of the following:<br>• Index Testing: grain size analysis, Atterberg Limits, moisture content<br>• Strength Testing: consolidated-undrained triaxial<br>• Settlement Testing: one-dimensional consolidation<br>• Material Re-Use Testing: Proctor Compaction, remolded permeability and strength<br>New Data: Cone penetrometer testing. Data obtained: continuous soil profile with tip resistance and sleeve friction strength values; pore pressure dissipation measurement to evaluate compressibility.<br>New Data: dilatometer testing measurement to evaluate settlement<br>New Data: Topographic mapping to provide an *x,y,z* reference datum for all data being collected<br>New Data: Groundwater measurements and analytical testing to determine existing groundwater conditions | The Chuckery Area (approximately 35 acres) is located within the Summit Metro Park, Cascade Valley Metro Park, Cuyahoga Falls, Ohio.<br>Highbridge trail (topo only)<br>River banks (topo only)<br>Laydown area<br>See Figure 4.<br>The testing is expected to be conducted on the fall of 2019 and take approximately 7 days to complete. | Specific testing will be based on a wholistic review of the SPT boring logs and CPT data collected and geotechnical engineering judgement.<br>Perform topographic by LIDAR and land surveying techniques in accordance with FGDC Geospatial Positioning Accuracy Standards Part 4. | By ASTM and by other acceptable geotechnical industry standards.<br>Horizontal topographic survey completed to an accuaracy of 1-foot contour intervals +/- 0.1 foot.<br>Vertical piezometer locations surveyed to +/-0.03 foot | Eight SPT borings advanced in the project area to 50 feet for visual classification and geotechnical sample collecting.<br>Three CPT soundings will be advanced to 50 feet for direct measurement of in situ properties.<br>Six temporary piezometers will be installed to measure water levels and collect groundwater samples.<br>Refer to Section 2 for additional details.<br>Create baseline conditions for ground elevations in the Chuckery Area, laydown area, and ~~P~~pipeline (Highbridge ~~t~~Trail) using land surveying techniques. Create topographic survey to tie into bathymetric survey by using land surveying or LIDAR aerial techniques |

[a] ASTM D 1586, Standard Method for Penetration Test and Split-Barrel Sampling of Soil.

Table 32. Sample Locations and ~~Parameters~~ Summary

*Cuyahoga River Gorge Dam Pool Sediments Site, Cuyahoga Falls, Ohio*

| Location ID | Latitude[a] | Longitude[a] | ~~Geotechnical Analysis[a]~~ | ~~Composite Samples[b,c]~~ |
|---|---|---|---|---|
| Sediment Sample Locations | | | | |
| GDA-SD-001 | 41.125683 | -81.485817 | ~~x~~ | x |
| GDA-SD-002 | 41.123182 | -81.487937 | ~~x~~ | |
| GDA-SD-003 | 41.122798 | -81.488002 | ~~x~~ | x |
| GDA-SD-004 | 41.121677 | -81.48846 | ~~x~~ | |
| GDA-SD-005 | 41.12057 | -81.489366 | ~~x~~ | x |
| GDA-SD-006 | 41.120228 | -81.490508 | ~~x~~ | |
| GDA-SD-007 | 41.119416 | -81.491258 | ~~x~~ | x |
| GDA-SD-008 | 41.118823 | -81.491687 | ~~x~~ | |
| GDA-SD-009 | 41.11844 | -81.492827 | ~~x~~ | x |
| GDA-SD-010 | 41.118643 | -81.493833 | ~~x~~ | |
| GDA-SD-011 | 41.118465 | -81.494405 | ~~x~~ | x |
| GDA-SD-012 | 41.118766 | -81.494812 | ~~x~~ | |
| GDA-SD-013 | 41.120584 | -81.495194 | ~~x~~ | x |
| GDA-SD-014 | 41.121354 | -81.495412 | ~~x~~ | |
| GDA-SD-015 | 41.122462 | -81.495574 | ~~x~~ | x |
| GDA-SD-016 | 41.122953 | -81.496503 | ~~x~~ | |
| Disposal Area Drilling/Sounding Locations | | | | |
| SPT-1 / PIZ-1 | -81.521102 | 41.118235 | | |
| SPT-2 / PIZ-2 | -81.518266 | 41.118096 | | |
| SPT-3 / PIZ-3 | -81.522994 | 41.115797 | | |
| SPT-4 / PIZ-4 | -81.521362 | 41.116415 | | |
| SPT-5 / PIZ-5 | -81.522877 | 41.114959 | | |
| SPT-6 / PIZ-6 | -81.519805 | 41.116871 | | |
| SPT-7 | -81.519889 | 41.119375 | | |
| SPT-8 | -81.519842 | 41.118045 | | |
| CPT-A | -81.520752 | 41.117222 | | |
| CPT-B | -81.519842 | 41.118045 | | |

**Commented [WD169]:** Parameters are given in new table 5

**Commented [SJ170]:** Section 2.2.1, Table 2 – Section 2.2.1 (Sediment Sampling) states, "The proposed investigation sample locations are shown on Figure 3. A summary of each proposed sample location's *x*, *y* coordinates and respective sampling parameters and analytical analysis are presented in Table 2." While sampling locations are identified by bullet markers in Figure 3, no coordinates are provided for the Gorge Dam Location ID numbers in Table 2. It's unclear whether the coordinates for these sample locations are already known, or if they are to be recorded during sampling, as is indicated in Section 2.2.1.1 (Surveying). If the coordinates for the sampling locations are currently known, Table 2 should be completed.

**Commented [WD171R170]:** Sample locations are given in table 2.
Sample parameters are given in table 5
Final sample locations TBD based on site access and conditions

**Commented [MG172]:** Look back at text, didn't get that each core would analyzed for geotech and then composite samples for treatability?

**Commented [AB173R172]:** Revised. Composite samples will just get Geotech sampling

**Commented [WD174R172]:** Parameters given in table 5

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Table ~~3~~2. Sample Locations and ~~Parameters~~ Summary

*Cuyahoga River Gorge Dam Pool Sediments Site, Cuyahoga Falls, Ohio*

| Location ID | Latitude[a] | Longitude[a] | ~~Geotechnical Analysis[b]~~ | ~~Composite Samples[b,c]~~ |
|---|---|---|---|---|
| CPT-C | -81.522877 | 41.114959 | | |

[a] ~~Easting and northin~~Latitude and Longitude~~s~~ coordinates in ~~North American Datum of 1983, Ohio State Plane-North Zone, U.S. survey feet~~ World Geodetic System (WGS) 1984

[b] ~~Geotechnical analysis: grain size-sieve (ASTM D6913), grain size-hydrometer (ASTM D7928), moisture content (ASTM D2216), organic content (ASTM D2974), Atterberg limits (ASTM D4318) and specific gravity (ASTM D584). Only 12 of the 16 locations will be analyzed for Atterberg limits and specific gravity, based on site conditions~~

[c] ~~Composite samples for treatability testing: Polymer and coagulant, Geotube rapid dewater test, Geotube dewatering test, density (in situ ASTM 2937). One pretreatment and seven post-treatment water sample(s) will be tested for: VOCs, SVOCs, pesticides, total and dissolved metals, TSS, pH, and alkalinity.~~

**Commented [WD169]:** Parameters are given in new table 5

**Commented [SJ170]:** Section 2.2.1, Table 2 – Section 2.2.1 (Sediment Sampling) states, "The proposed investigation sample locations are shown on Figure 3. A summary of each proposed sample location's *x*, *y* coordinates and respective sampling parameters and analytical analysis are presented in Table 2." While sampling locations are identified by bullet markers in Figure 3, no coordinates are provided for the Gorge Dam Location ID numbers in Table 2. It's unclear whether the coordinates for these sample locations are already known, or if they are to be recorded during sampling, as is indicated in Section 2.2.1.1 (Surveying). If the coordinates for the sampling locations are currently known, Table 2 should be completed.

**Commented [WD171R170]:** Sample locations are given in table 2.
Sample parameters are given in table 5
Final sample locations TBD based on site access and conditions

**Commented [MG172]:** Look back at text, didn't get that each core would analyzed for geotech and then composite samples for treatability?

**Commented [AB173R172]:** Revised. Composite samples will just get Geotech sampling

**Commented [WD174R172]:** Parameters given in table 5

**Commented [WD175]:** Shown in table 5

**Commented [WD176]:** Moved to table 5

Table 43. Sample Containers, Preservatives, and Holding Times
*Cuyahoga River Gorge Dam GLLA Project, Cuyahoga Falls, Ohio*

| Analysis | Method | Matrix | Sample Container[a] | Preservation | Holding Times[b] |
|---|---|---|---|---|---|
| ***Geotechnical Soil*** | | | | | |
| Moisture Content | ASTM D 2216 | Soil | Jar | — | — |
| Grain Size | ASTM D 6913 | Soil | Jar | — | — |
| Atterberg Limits | ASTM D 4318 | Soil | Jar | — | — |
| One-dimensional Consolidation | ASTM D 2435 | Soil | Shelby tube | — | — |
| CU Triaxial | ASTM D 4767 | Soil | Shelby tube | | |
| Density Determination | ASTM D 7263 | Soil | Shelby tube | — | — |
| Hydraulic conductivity | ASTM D5084 | Soil | Shelby tube | | |
| Specific Gravity | ASTM D 854 | Soil | Shelby tube/jar | — | — |
| ***Geotechnical Sediment*** | | | | | |
| Moisture Content | ASTM D 2216 | Sediment | Jar | — | — |
| Grain Size | ASTM D 6913 / 7928 | Sediment | Jar | — | — |
| Atterberg Limits | ASTM D 4318 | Sediment | Jar | — | — |
| Organic Content | ASTM D 2974 | Sediment | Jar | — | — |
| Specific Gravity | ASTM D 854 | Sediment | Jar | — | — |
| ***Treatability Bulk Sediment and Water*** | | | | | |
| Bulk Sediment | — | Sediment | 5-gallon bucket | — | — |
| Bulk Water | — | Water | 5-gallon bucket | — | — |
| ***Elutriate and Effluent Water*** | | | | | |
| VOC | SW-846 8260 | Aqueous | 3 × 40-mL volatile organics analysis | ≤6°C, HCl to pH <2 | 14 days analyze (no head space) |
| SVOC | SW-846 8270D | Aqueous | 2 × 1-L amber G-TLC | ≤6°C | 7 days extract<br>40 days analyze |
| Pesticides | SW-846 8081 | Aqueous | 2 × 1-L amber G-TLC | ≤6°C | 7 days extract<br>40 days analyze |
| Total metals (including mercury) | Method 6010/6020/7470 | Aqueous | 1 × 250-mL HDPE | ≤6°C, HNO3 to pH <2 | 180 days (28 days for mercury) analyze |
| Dissolved Metals (including mercury) | Method 6010/6020 | Aqueous | 1 × 250-mL HDPE | ≤6°C, HNO3 to pH <2 | 180 days (28 days for mercury) analyze |
| TSS | SM 2540 D | Aqueous | 1 × 1-L HDPE | ≤6°C | 7 days |
| pH | SW-846 9040 | Aqueous | 1 × 250-mL HDPE | ≤6°C | immediately |
| Alkalinity | SM 2320B | Aqueous | 1 × 250-mL HDPE | ≤6°C | 14 days |

**Commented [SJ177]:** Table 3 – Table 3 (Sample Containers, Preservatives, and Holding Times) identifies the requirement for both total and dissolved metals analysis including mercury analysis; however, there is no mercury method listed alongside the metals method. SW-846 Method 7470 should be included with Methods 6010/6020 for the aqueous samples

**Commented [EJ178R177]:** Method 7470 added

Table 43. Sample Containers, Preservatives, and Holding Times

*Cuyahoga River Gorge Dam GLLA Project, Cuyahoga Falls, Ohio*

| Analysis | Method | Matrix | Sample Container[a] | Preservation | Holding Times[b] |
|---|---|---|---|---|---|
| ***Groundwater and Equipment Blank*** | | | | | |
| PAH | SW-846 8270 | Aqueous | 2 × 1-L amber G-TLC | ≤6˚C | 7 days extract |
| Total metals (Cd and Pb) | SW-846 6010/6020 | Aqueous | 1 × 250-mL poly | ≤6˚C, HNO3 to pH <2 | 180 days analyze |
| ***Waste Characterization*** | | | | | |
| TCLP VOC | SW-846 1311/8260 | Solid | | ≤6˚C | 14 days to TCLP extraction,<br>14 days to analysis |
| TCLP SVOC | SW-846 1311/8270 | Solid | | ≤6˚C | 14 days to TCLP extraction,<br>7 days to extraction,<br>40 days to analysis |
| TCLP Pesticides | SW-846 1311/8081 | Solid | | ≤6˚C | 14 days to TCLP extraction,<br>7 days to extraction,<br>40 days to analysis |
| TCLP Herbicides | SW-846 1311/8151 | Solid | 7 × 4-oz glass | ≤6˚C | 14 days to TCLP extraction,<br>7 days to extraction,<br>40 days to analysis |
| TCLP Metals | SW-846 1311/6010C/7470 | Solid | | ≤6˚C | 180 days (28 days Hg) to TCLP extraction,<br>180 days (28 days Hg) to analysis |
| PCBs | SW-846 8082 | Solid | | ≤6˚C | 1-year extraction<br>1-year analysis |
| pH/Corrosivity | SW-846 9045 | Solid | | ≤6˚C | 7 days |
| Ignitability | SW-846 1030 | Solid | | ≤6˚C | 10 days |
| VOC | SW-846 8260 | Aqueous | 3 × 40-mL volatile organics analysis | ≤6˚C, HCl to pH <2 | 14 days analyze (no head space) |
| SVOC | SW-846 8270 | Aqueous | 2 × 1-L amber G-TLC | ≤6˚C | 7 days extract<br>40 days analyze |
| Pesticides | SW-846 8081 | Aqueous | 2 × 1-L amber G-TLC | ≤6˚C | 7 days extract<br>40 days analyze |
| Herbicides | SW-846 8151 | Aqueous | 2 × 1-L amber G-TLC | <6˚C | 7 days extract<br>40 days analyze |
| Metals | SW-846 6010/7470 | Aqueous | 1 × 250-mL HDPE | <6°C, HNO3 to pH <2 | 180 days (28 days for mercury) analyze |
| PCBs | SW-846 8082 | Aqueous | 2 × 250-mL amber | <6˚C | 7 days extract<br>40 years analyze |
| pH/Corrosivity | SW-846 9040 | Aqueous | 1 × 250-mL HDPE | <6˚C | Immediately |

Table 43. Sample Containers, Preservatives, and Holding Times

*Cuyahoga River Gorge Dam GLLA Project, Cuyahoga Falls, Ohio*

| Analysis | Method | Matrix | Sample Container[a] | Preservation | Holding Times[b] |
|---|---|---|---|---|---|
| Flash point | SW-846 1010 | Aqueous | 1 × 250-mL glass G-TLC | NA | 30 days |

[a] Container and quantity requirements may be adjusted pending lab procurement.

[b]Holding times are from the time of sample collection.

G-TLC = glass with Teflon-lined cap; HDPE = high-density polyethylene

Table 54. Summary of Geotechnical Parameters and Sample Quantities

*Gorge River Sediments Site, Cuyahoga Falls, Ohio*

| Analysis | Method | No. of Samples |
|---|---|---|
| | Sediment Sampling | |
| Grain Size Analysis (Sieve) | ASTM D422 | 8 |
| Grain Size Analysis (Hydrometer) | ASTM D7928 | 8 |
| Moisture Content | ASTM D2216 | 8 |
| Organic Content | ASTM D2974 | 8 |
| Atterberg Limits | ASTM D4318 | 8 |
| Specific Gravity | ASTM D854 | 8 |
| Density | ASTM D2937 | 8 |
| Polymer and Coagulant | Aqua Survey – In House | 8 |
| Geotube® Rapid Dewater Test | Geotube® Standard | 8 |
| Geotube® Dewatering Testing | Geotube® Standard | 8 |
| VOC | SW-846 8260 | 8* |
| SVOC | SW-846 8270D | 8* |
| Pesticides | SW-846 8081 | 8* |
| Total metals (including mercury) | Method 6010/6020/7470 | 8* |
| Dissolved Metals (including mercury) | Method 6010/6020 | 8* |
| TSS | SM 2540 D | 8* |
| pH | SW-846 9040 | 8* |
| Alkalinity | SM 2320B | 8* |
| | Disposal Area Sampling*** | |
| Moisture Content | ASTM D 2216 | 131 |
| Grain Size (Sieve) | ASTM D 6913 | 32 |
| Grain Size (Hydrometer) | ASTM D 7928 | 8 |
| Atterberg Limits | ASTM D 4318 | 24 |
| Specific Gravity | ASTM D 854 | 4 |
| Organic Content | ASTM D 2974 | 3 |
| Proctor Compaction | ASTM D 698 | 3 |
| One—dimensional Consolidation | ASTM D 2435 | 3 |
| CU Triaxial | ASTM D 4767 | 3 |
| Density Determination | ASTM D 7263 | 12 |
| Hydraulic conductivity | ASTM D5084 | 6 |

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**Commented [SJ179]:** Table 3 – Table 3 (Sample Containers, Preservatives, and Holding Times) identifies the requirement for both total and dissolved metals analysis including mercury analysis; however, there is no mercury method listed alongside the metals method. SW-846 Method 7470 should be included with Methods 6010/6020 for the aqueous samples

**Commented [EJ180R179]:** Method 7470 added

**Commented [WD181R179]:** Copied from above

**Commented [MG182]:** How did you come up with the number of samples?

**Commented [WD183R182]:** Moisture – roughly one per split spoon plus extras for tests associated with collecting Shelby tubes.
Grain size – four per boring
Hydro—one per boring
Atterberg limits – three per boring
SG—one every other boring
OG, Proctor, 1-D, CU one every third boring (rounded up)
Density – associated with CU and hyd. Conductivity samples

*One pre-treatment and seven post--treatment water samples

**Moisture – approximately one per split spoon plus extras for tests associated with collecting Shelby tubes.

Grain size – four per boring

Hydrometer—one per boring

Atterberg limits – three per boring

Specific Gravity—one every other boring

Organic content, Proctor, 1-Dimensional consolidation, CU triaxial one every third boring (rounded up)

Density – associated with CU triaxial and hydraulic conductivity samples

Table 65. Waste Characterization Parameters and Action Limits (Solid and Aqueous)
*Cuyahoga River Gorge Dam GLLA Project, Cuyahoga Falls, Ohio*

| Analyte | CAS Number | Project Action Limit (mg/L)[a] | Achievable Laboratory Limits | | Method |
|---|---|---|---|---|---|
| | | | Method Detection Limits (mg/L) | Reporting Limits (mg/L) | |
| ***RCRA 8 Metals (Total and/or TCLP)*** | | | | | |
| Arsenic | 7440-38-2 | 5 | 0.00019 | 0.005 | SW846 6010C |
| Barium | 7440-39-3 | 100 | 0.002 | 0.005 | SW846 6010C |
| Cadmium | 7440-43-9 | 1 | 0.00015 | 0.002 | SW846 6010C |
| Chromium | 7440-47-3 | 5 | 0.00061 | 0.005 | SW846 6010C |
| Lead | 7439-92-1 | 100 | 0.00072 | 0.005 | SW846 6010C |
| Selenium | 7782-49-2 | 5 | 0.00048 | 0.005 | SW846 6010C |
| Silver | 7440-22-4 | 1 | 0.00034 | 0.005 | SW846 6010C |
| Mercury | 7439-97-6 | 5 | 0.00016 | 0.0002 | SW846 7471 |
| Total Metals | - | - | - | - | - |
| ***VOCs (Total and/or TCLP)*** | | | | | |
| 1,1-Dichloroethene | 75-35-4 | 0.7 | 0.0004 | 0.001 | SW846 8260C |
| 1,2-Dichloroethane | 107-06-2 | 0.5 | 0.00044 | 0.001 | SW846 8260C |
| 1,4-Dichlorobenzene* | 106-46-7 | 7.5 | 0.00032 | 0.005 | SW846 8260C |
| 2-Butanone (MEK) | 78-93-3 | 200 | 0.00052 | 0.005 | SW846 8260C |
| Benzene | 71-43-2 | 0.5 | 0.00046 | 0.001 | SW846 8260C |
| Carbon tetrachloride | 56-23-5 | 0.5 | 0.0004 | 0.001 | SW846 8260C |
| Chlorobenzene | 108-90-7 | 100 | 0.0004 | 0.001 | SW846 8260C |
| Chloroform | 67-66-3 | 6 | 0.00046 | 0.001 | SW846 8260C |
| Trichloroethene | 79-01-6 | 0.5 | 0.00043 | 0.001 | SW846 8260C |
| Tetrachloroethene | 127-18-4 | 0.7 | 0.00039 | 0.001 | SW846 8260C |
| Vinyl Chloride | 75-01-4 | -- | 0.00053 | 0.001 | SW846 8260C |
| Total VOCs | - | - | | | - |
| ***SVOCs (Total and/or TCLP)*** | | | | | |
| 2,4-Dinitrotoluene | 121-14-2 | 0.13 | 0.00042 | 0.005 | SW846 8270D |
| Hexachlorobenzene | 118-74-1 | 0.13 | 0.00044 | 0.005 | SW846 8270D |
| Hexachlorobutadiene | 87-68-3 | 0.5 | 0.00028 | 0.005 | SW846 8270D |
| Hexachloroethane | 67-72-1 | 3 | 0.00021 | 0.005 | SW846 8270D |
| Nitrobenzene | 98-95-3 | 2 | 0.00026 | 0.005 | SW846 8270D |
| Pyridine | 110-86-1 | 5 | 0.0001 | 0.01 | SW846 8270D |

**Commented [SJ184]:** Mark Loomis: Providing all information missing from this draft, including identification of subcontractors and analytical laboratories that are currently identified as "TBD", and adding the analytical laboratory Standard Operating Procedures (SOPs) to Appendix A;

**Commented [EJ185R184]:** Updated with ALS Holland limits

Table 65. Waste Characterization Parameters and Action Limits (Solid and Aqueous)
*Cuyahoga River Gorge Dam GLLA Project, Cuyahoga Falls, Ohio*

| Analyte | CAS Number | Project Action Limit (mg/L)[a] | Achievable Laboratory Limits: Method Detection Limits (mg/L) | Achievable Laboratory Limits: Reporting Limits (mg/L) | Method |
|---|---|---|---|---|---|
| 2,4,5-Trichlorophenol | 95-95-4 | 400 | 0.00017 | 0.005 | SW846 8270D |
| 2,4,6-Trichlorophenol | 88-06-2 | 2 | 0.00025 | 0.005 | SW846 8270D |
| 2-Methylphenol (o-cresol) | 95-48-7 | 200 | 0.000193 | 0.005 | SW846 8270D |
| 3-Methylphenol (m-cresol) | 108-39-4 | 200 | 0.000196 | 0.005 | SW846 8270D |
| 4-Methylphenol (p-cresol) | 106-44-5 | 200 | 0.000196 | 0.005 | SW846 8270D |
| Pentachlorophenol | 87-86-5 | 100 | 0.00097 | 0.005 | SW846 8270D |
| Total SVOCs | - | - | - | - | - |
| ***PCBs*** | | | | | |
| Aroclor 1016 | 12674-11-2 | 0.0003 | 0.00009 | 0.0002 | SW846 8082 |
| Aroclor 1221 | 11104-28-2 | 0.0003 | 0.00009 | 0.0002 | SW846 8082 |
| Aroclor 1232 | 11141-16-5 | 0.0003 | 0.00009 | 0.0002 | SW846 8082 |
| Aroclor 1242 | 53469-21-9 | 0.0003 | 0.00009 | 0.0002 | SW846 8082 |
| Aroclor 1248 | 12672-29-6 | 0.0003 | 0.00009 | 0.0002 | SW846 8082 |
| Aroclor 1254 | 11097-69-1 | 0.0003 | 0.000091 | 0.0002 | SW846 8082 |
| Aroclor 1260 | 11096-82-5 | 0.0003 | 0.000091 | 0.0002 | SW846 8082 |
| Aroclor 1262 | 37324-23-5 | 0.0003 | 0.000091 | 0.0002 | SW846 8082 |
| Aroclor 1268 | 11100-14-4 | 0.0003 | 0.000091 | 0.0002 | SW846 8082 |
| Total PCBs | - | - | - | - | - |
| ***Herbicides (Total and or TCLP)*** | | | | | |
| 2,4-D | 94-75-7 | 10 | 0.00192 | 0.01 | SW847 8151 |
| Silvex (2,4,5-TP) | 93-72-1 | 1 | 0.00329 | 0.01 | SW847 8151 |
| Total Herbicides | - | - | - | - | - |
| ***Pesticides (Total and or TCLP)*** | | | | | |
| Gamma-BHC (Lindane) | 58-89-9 | 0.4 | 0.0000065 | 0.00001 | SW846 8081 |
| Alpha-Chlordane | 5103-71-9 | -- | 0.000008 | 0.00002 | SW846 8081 |
| Gamma-Chlordane | 5103-74-2 | -- | 0.000008 | 0.00002 | SW846 8081 |
| Chlordane | 57-74-9 | 0.03 | 0.000034 | 0.0005 | SW846 8081 |
| Endrin | 72-20-8 | 0.02 | 0.000011 | 0.00002 | SW846 8081 |
| Heptachlor | 76-44-8 | 0.008 | 0.0000096 | 0.00001 | SW846 8081 |

**Commented [SJ184]:** Mark Loomis: Providing all information missing from this draft, including identification of subcontractors and analytical laboratories that are currently identified as "TBD", and adding the analytical laboratory Standard Operating Procedures (SOPs) to Appendix A;

**Commented [EJ185R184]:** Updated with ALS Holland limits

Table 65. Waste Characterization Parameters and Action Limits (Solid and Aqueous)
*Cuyahoga River Gorge Dam GLLA Project, Cuyahoga Falls, Ohio*

| Analyte | CAS Number | Project Action Limit (mg/L)[a] | Achievable Laboratory Limits: Method Detection Limits (mg/L) | Achievable Laboratory Limits: Reporting Limits (mg/L) | Method |
|---|---|---|---|---|---|
| Heptachlor Epoxide | 1024-57-3 | 0.008 | 0.0000087 | 0.00001 | SW846 8081 |
| Methoxychlor | 72-43-5 | 10 | 0.000019 | 0.00004 | SW846 8081 |
| Toxaphene | 8001-35-2 | 0.5 | 0.00011 | 0.002 | SW846 8081 |
| Total Pesticides | - | - | - | - | - |
| Flashpoint/Ignitability | - | - | 50-200 °F<br>Below 50 °F = < 50<br>Over 200 °F = > 200 | | SW846-1010/1030 |
| pH/Corrosivity[b] | - | - | 0.1 to 14 SU | | SW846 9045 |

[a] Project action limits from 40 CFR Part 261 Subpart C are applicable to both Total sample results and TCLP sample results.

[b] Corrosivity characteristics and reactivity analysis method are not recognized by the EPA associated methods and parameters in the event that the waste facility requires the information.

* 1,4-Dichlorobenzene will be analyzed using method SW-846 8270

mg/L = milligram per liter; TCLP = toxicity characteristic leaching procedure

**Commented [SJ184]:** Mark Loomis: Providing all information missing from this draft, including identification of subcontractors and analytical laboratories that are currently identified as "TBD", and adding the analytical laboratory Standard Operating Procedures (SOPs) to Appendix A;

**Commented [EJ185R184]:** Updated with ALS Holland limits

Table 76. Method Reporting Limits
*Cuyahoga River Gorge Dam GLLA Project, Cuyahoga Falls, Ohio*

| | | | Achievable Laboratory Limits | | | |
|---|---|---|---|---|---|---|
| | | | Effluent/ ~~Elutriate~~ Aqueous | | Groundwater | |
| Parameter | CAS No. | Unit | RL | MDL | RL | MDL |
| ***Volatile Organic Compounds by SW-846 8260*** | | | | | | |
| Acetone | 67-64-1 | µg/L | 10.0 | 1.09 | - | - |
| Benzene | 71-43-2 | µg/L | 1.0 | 0.46 | - | - |
| Bromochloromethane | 74-97-5 | µg/L | 1.0 | 0.45 | - | - |
| Bromodichloromethane | 75-27-4 | µg/L | 1.0 | 0.49 | - | - |
| Bromoform | 75-25-2 | µg/L | 1.0 | 0.56 | - | - |
| Bromomethane | 74-83-9 | µg/L | 1.0 | 0.90 | - | - |
| 2-Butanone | 78-93-3 | µg/L | 5.0 | 0.56 | - | - |
| Carbon disulfide | 75-15-0 | µg/L | 1.0 | 0.49 | - | - |
| Carbon tetrachloride | 56-23-5 | µg/L | 1.0 | 0.40 | - | - |
| Chlorobenzene | 108-90-7 | µg/L | 1.0 | 0.40 | - | - |
| Chloroethane | 75-00-3 | µg/L | 1.0 | 0.68 | - | - |
| Chloroform | 67-66-3 | µg/L | 1.0 | 0.46 | - | - |
| Chloromethane | 74-87-3 | µg/L | 1.0 | 0.83 | - | - |
| cis-1,2-Dichloroethene | 156-59-2 | µg/L | 1.0 | 0.42 | - | - |
| cis-1,3-Dichloropropene | 10061-01-5 | µg/L | 1.0 | 0.57 | - | - |
| Cyclohexane | 110-82-7 | µg/L | 2.0 | 0.63 | - | - |
| Dibromochloromethane | 124-48-1 | µg/L | 1.0 | 0.40 | - | - |
| 1,2-Dibromoethane | 106-93-4 | µg/L | 1.0 | 0.41 | - | - |
| 1,2-Dichlorobenzene | 95-50-1 | µg/L | 1.0 | 0.32 | - | - |
| 1,3-Dichlorobenzene | 541-73-1 | µg/L | 1.0 | 0.33 | - | - |
| 1,4-Dichlorobenzene | 106-46-7 | µg/L | 1.0 | 0.35 | - | - |
| Dichlorodifluoromethane | 75-71-8 | µg/L | 1.0 | 0.68 | - | - |
| 1,1-Dichloroethane | 75-34-3 | µg/L | 1.0 | 0.44 | - | - |
| 1,2-Dichloroethane | 107-06-2 | µg/L | 1.0 | 0.44 | - | - |
| 1,1-Dichloroethene | 75-35-4 | µg/L | 1.0 | 0.40 | - | - |
| 1,2-Dichloropropane | 78-87-5 | µg/L | 1.0 | 0.48 | - | - |
| Ethylbenzene | 100-41-4 | µg/L | 1.0 | 0.34 | - | - |
| 2-Hexanone | 591-78-6 | µg/L | 5.0 | 0.59 | - | - |
| Isopropylbenzene | 98-82-8 | µg/L | 1.0 | 0.35 | - | - |

**Commented [SJ186]:** Mark Loomis: Providing all information missing from this draft, including identification of subcontractors and analytical laboratories that are currently identified as "TBD", and adding the analytical laboratory Standard Operating Procedures (SOPs) to Appendix A;

**Commented [EJ187R186]:** updated

Table 7~~6~~. Method Reporting Limits

*Cuyahoga River Gorge Dam GLLA Project, Cuyahoga Falls, Ohio*

| | | | Achievable Laboratory Limits | | | |
|---|---|---|---|---|---|---|
| | | | Effluent/ ~~Elutriate~~ Aqueous | | Groundwater | |
| Parameter | CAS No. | Unit | RL | MDL | RL | MDL |
| m&p-Xylene | 108-38-3 / 106-42-3 | µg/L | 2.0 | 0.81 | - | - |
| 4-Methyl-2-pentanone | 108-10-1 | µg/L | 1.0 | 0.52 | - | - |
| Methyl acetate | 79-20-9 | µg/L | 2.0 | 0.59 | - | - |
| Methyl tert-butyl ether | 1634-04-4 | µg/L | 1.0 | 0.45 | - | - |
| Methylcyclohexane | 108-87-2 | µg/L | 1.0 | 0.35 | - | - |
| Methylene chloride | 75-09-2 | µg/L | 5.0 | 0.86 | - | - |
| o-Xylene | 95-47-6 | µg/L | 1.0 | 0.31 | - | - |
| 2,2-Oxybis-1-chloropropane[3] | 39638-32-9 | µg/L | 1.0 | 0.230 | - | - |
| Styrene | 100-42-5 | µg/L | 1.0 | 0.33 | - | - |
| 1,1,2,2-Tetrachloroethane | 79-34-5 | µg/L | 1.0 | 0.38 | - | - |
| Tetrachloroethene | 127-18-4 | µg/L | 1.0 | 0.39 | - | - |
| Toluene | 108-88-3 | µg/L | 1.0 | 0.45 | - | - |
| trans-1,2-Dichloroethene | 156-60-5 | µg/L | 1.0 | 0.48 | - | - |
| trans-1,3-Dichloropropene | 10061-02-6 | µg/L | 1.0 | 0.38 | - | - |
| 1,1,2-trichloro-1,2,2-trifluoroethane | 76-13-1 | µg/L | 1.0 | 0.52 | - | - |
| 1,2,3-Trichlorobenzene | 87-61-6 | µg/L | 1.0 | 0.42 | - | - |
| 1,2,4-Trichlorobenzene | 120-82-1 | µg/L | 1.0 | 0.45 | - | - |
| 1,1,1-Trichloroethane | 71-55-6 | µg/L | 1.0 | 0.46 | - | - |
| 1,1,2-Trichloroethane | 79-00-5 | µg/L | 1.0 | 0.46 | - | - |
| Trichloroethene | 79-01-6 | µg/L | 1.0 | 0.43 | - | - |
| Trichlorofluoromethane | 75-69-4 | µg/L | 1.0 | 0.52 | - | - |
| Vinyl chloride | 75-01-4 | µg/L | 1.0 | 0.53 | - | - |
| ***Semivolatile Organic Compounds by SW-846 8270*** | | | | | | |
| Acenaphthene | 83-32-9 | µg/L | 0.1 | 0.081 | - | - |
| Acenaphthylene | 208-96-8 | µg/L | 0.1 | 0.075 | - | - |
| Acetophenone | 98-86-2 | µg/L | 1.0 | 0.370 | - | - |
| Anthracene | 120-12-7 | µg/L | 0.1 | 0.023 | - | - |
| Atrazine | 140-57-8 | µg/L | 1.0 | 0.350 | - | - |
| Benzaldehyde | 100-52-7 | µg/L | 1.0 | 0.520 | - | - |
| Benzo[a]anthracene | 56-55-3 | µg/L | 0.1 | 0.099 | - | - |

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**Commented [EJ187R186]:** updated

Table 76. Method Reporting Limits
*Cuyahoga River Gorge Dam GLLA Project, Cuyahoga Falls, Ohio*

| | | | Achievable Laboratory Limits | | | |
|---|---|---|---|---|---|---|
| | | | Effluent/~~-Elutriate~~ Aqueous | | Groundwater | |
| Parameter | CAS No. | Unit | RL | MDL | RL | MDL |
| Benzo[a]pyrene | 50-32-8 | µg/L | 0.1 | 0.044 | - | - |
| Benzo[b]fluoranthene | 205-99-2 | µg/L | 0.1 | 0.051 | - | - |
| Benzo[g,h,i]perylene | 191-24-2 | µg/L | 0.1 | 0.030 | - | - |
| Benzo[k]fluoranthene | 207-08-9 | µg/L | 0.1 | 0.048 | - | - |
| 1,1-Biphenyl | 92-52-4 | µg/L | 1.0 | 0.420 | - | - |
| Bis(2-chloroethoxy)methane | 111-91-1 | µg/L | 1.0 | 0.290 | - | - |
| Bis(2-chloroethyl)ether | 111-44-4 | µg/L | 1.0 | 0.370 | - | - |
| Bis(2-ethylhexyl)phthalate | 117-81-7 | µg/L | 1.0 | 0.400 | - | - |
| 4-Bromophenyl phenylether | 101-55-3 | µg/L | 1.0 | 0.330 | - | - |
| Butylbenzylphthalate | 85-68-7 | µg/L | 1.0 | 0.300 | - | - |
| Caprolactam | 105-60-2 | µg/L | 5.0 | 0.960 | - | - |
| Carbazole | 86-74-8 | µg/L | 1.0 | 0.240 | - | - |
| 4-Chloro-3-Methylphenol | 59-50-7 | µg/L | 1.0 | 0.260 | - | - |
| 4-Chloroaniline | 106-47-8 | µg/L | 1.0 | 0.340 | - | - |
| 2-Chloronaphthalene | 91-58-7 | µg/L | 0.1 | 0.075 | - | - |
| 2-Chlorophenol | 95-57-8 | µg/L | 1.0 | 0.230 | - | - |
| 4-Chlorophenyl phenylether | 7005-72-3 | µg/L | 1.0 | 0.310 | - | - |
| Chrysene | 218-01-9 | µg/L | 0.1 | 0.048 | - | - |
| Di-n-butylphthalate | 84-74-2 | µg/L | 1.0 | 0.210 | - | - |
| Di-n-octylphthalate | 117-84-0 | µg/L | 1.0 | 0.530 | - | - |
| Dibenzo[a,h]anthracene | 53-70-3 | µg/L | 0.1 | 0.073 | - | - |
| Dibenzofuran | 132-64-9 | µg/L | 1.0 | 0.230 | - | - |
| 1,2-Dibromo-3-chloropropane[b] | 96-12-8 | µg/L | 1.0 | 0.430 | - | - |
| 3,3-Dichlorobenzidine | 91-94-1 | µg/L | 5.0 | 0.460 | - | - |
| 2,4-Dichlorophenol | 120-83-2 | µg/L | 1.0 | 0.350 | - | - |
| Diethylphthalate | 84-66-2 | µg/L | 1.0 | 0.170 | - | - |
| 2,4-Dimethylphenol | 105-67-9 | µg/L | 1.0 | 0.360 | - | - |
| Dimethylphthalate | 131-11-3 | µg/L | 1.0 | 0.180 | - | - |
| 4,6-Dinitro-2-methylphenol | 534-52-1 | µg/L | 1.0 | 0.270 | - | - |
| 2,4-Dinitrophenol | 51-28-5 | µg/L | 5.0 | 2.610 | - | - |

**Commented [SJ186]:** Mark Loomis: Providing all information missing from this draft, including identification of subcontractors and analytical laboratories that are currently identified as "TBD", and adding the analytical laboratory Standard Operating Procedures (SOPs) to Appendix A;

**Commented [EJ187R186]:** updated

Table 7~~6~~. Method Reporting Limits
*Cuyahoga River Gorge Dam GLLA Project, Cuyahoga Falls, Ohio*

| | | | Achievable Laboratory Limits | | | |
|---|---|---|---|---|---|---|
| | | | Effluent/ ~~Elutriate~~ Aqueous | | Groundwater | |
| Parameter | CAS No. | Unit | RL | MDL | RL | MDL |
| 2,4-Dinitrotoluene | 121-14-2 | µg/L | 1.0 | 0.420 | - | - |
| 2,6-Dinitrotoluene | 606-20-2 | µg/L | 1.0 | 0.330 | - | - |
| Fluoranthene | 206-44-0 | µg/L | 0.1 | 0.038 | - | - |
| Fluorene | 86-73-7 | µg/L | 0.1 | 0.051 | - | - |
| Hexachlorobenzene | 118-74-1 | µg/L | 1.0 | 0.440 | - | - |
| Hexachlorobutadiene | 87-68-3 | µg/L | 1.0 | 0.280 | - | - |
| Hexachlorocyclopentadiene | 77-47-4 | µg/L | 5.0 | 1.090 | - | - |
| Hexachloroethane | 67-72-1 | µg/L | 1.0 | 0.210 | - | - |
| Indeno[1,2,3-c,d]pyrene | 193-39-5 | µg/L | 0.1 | 0.067 | - | - |
| Isophorone | 78-59-1 | µg/L | 5.0 | 0.340 | - | - |
| 2-Methylnaphthalene | 91-57-6 | µg/L | 0.1 | 0.065 | - | - |
| 2-Methylphenol | 95-48-7 | µg/L | 1.0 | 0.250 | - | - |
| 4-Methylphenol | 106-44-5 | µg/L | 1.0 | 0.210 | - | - |
| N-Nitroso-di-n-propylamine | 621-64-7 | µg/L | 1.0 | 0.350 | - | - |
| N-Nitrosodiphenylamine | 86-30-6 | µg/L | 1.0 | 0.490 | - | - |
| Naphthalene | 91-20-3 | µg/L | 0.1 | 0.067 | - | - |
| 2-Nitroaniline | 88-74-4 | µg/L | 1.0 | 0.210 | - | - |
| 3-Nitroaniline | 99-09-2 | µg/L | 1.0 | 0.640 | - | - |
| 4-Nitroaniline | 100-01-6 | µg/L | 1.0 | 0.570 | - | - |
| Nitrobenzene | 98-95-3 | µg/L | 1.0 | 0.260 | - | - |
| 2-Nitrophenol | 88-75-5 | µg/L | 1.0 | 0.340 | - | - |
| 4-Nitrophenol | 100-02-7 | µg/L | 5.0 | 0.240 | - | - |
| Pentachlorophenol | 87-86-5 | µg/L | 5.0 | 0.970 | - | - |
| Phenanthrene | 85-01-8 | µg/L | 0.1 | 0.081 | - | - |
| Phenol | 108-95-2 | µg/L | 1.0 | 0.210 | - | - |
| Pyrene | 129-00-0 | µg/L | 0.1 | 0.036 | - | - |
| 1,2,4,5-Tetrachlorobenzene | 95-94-3 | µg/L | 5.0 | 0.340 | - | - |
| 2,3,4,6-Tetrachlorophenol | 58-90-2 | µg/L | 1.0 | 0.450 | - | - |
| 2,4,5-Trichlorophenol | 95-95-4 | µg/L | 1.0 | 0.170 | - | - |
| 2,4,6-Trichlorophenol | 88-06-2 | µg/L | 1.0 | 0.250 | - | - |

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**Commented [EJ187R186]:** updated

Table 7~~6~~. Method Reporting Limits
*Cuyahoga River Gorge Dam GLLA Project, Cuyahoga Falls, Ohio*

| | | | Achievable Laboratory Limits | | | |
|---|---|---|---|---|---|---|
| | | | Effluent/~~Elutriate~~ Aqueous | | Groundwater | |
| **Parameter** | **CAS No.** | **Unit** | **RL** | **MDL** | **RL** | **MDL** |
| ***Pesticides by SW-846 8081*** | | | | | | |
| Aldrin | 309-00-2 | µg/L | 0.01 | 0.0076 | - | - |
| alpha-BHC | 319-84-6 | µg/L | 0.01 | 0.0089 | - | - |
| alpha-Chlordane | 5103-71-9 | µg/L | 0.02 | 0.0080 | - | - |
| beta-BHC | 319-95-7 | µg/L | 0.01 | 0.0086 | - | - |
| 4,4'-DDD | 72-54-8 | µg/L | 0.02 | 0.0094 | - | - |
| 4,4'-DDE | 72-55-9 | µg/L | 0.02 | 0.0081 | - | - |
| 4,4'-DDT | 50-29-3 | µg/L | 0.02 | 0.0150 | - | - |
| Total DDTs | - | µg/L | - | - | - | - |
| delta-BHC | 319-86-8 | µg/L | 0.02 | 0.0139 | - | - |
| Dieldrin | 60-57-1 | µg/L | 0.02 | 0.0075 | - | - |
| Endosulfan I | 959-98-8 | µg/L | 0.02 | 0.0078 | - | - |
| Endosulfan II | 33213-65-9 | µg/L | 0.02 | 0.0088 | - | - |
| Endosulfan Sulfate | 1031-07-8 | µg/L | 0.02 | 0.0082 | - | - |
| Endrin | 72-20-8 | µg/L | 0.02 | 0.0110 | - | - |
| Endrin Aldehyde | 7421-93-4 | µg/L | 0.02 | 0.0081 | - | - |
| Endrin Ketone | 53474-70-5 | µg/L | 0.02 | 0.0100 | - | - |
| gamma-BHC (Lindane) | 58-89-9 | µg/L | 0.01 | 0.0065 | - | - |
| gamma-Chlordane | 5103-74-2 | µg/L | 0.02 | 0.0080 | - | - |
| Heptachlor | 76-44-8 | µg/L | 0.01 | 0.0096 | - | - |
| Heptachlor Epoxide | 1024-57-3 | µg/L | 0.01 | 0.0087 | - | - |
| Methoxychlor | 72-43-5 | µg/L | 0.04 | 0.0190 | - | - |
| Toxaphene | 8001-35-2 | µg/L | 2.00 | 0.1100 | - | - |
| ***Metals by SW-846 6010/6020/7470*** *(Total and Dissolved)* | | | | | | |
| Aluminum | 7429-90-5 | µg/L | 10 | 8.00 | - | - |
| Antimony | 7440-36-0 | µg/L | 5 | 2.00 | - | - |
| Arsenic | 7440-38-2 | µg/L | 5 | 0.19 | - | - |
| Barium | 7440-39-3 | µg/L | 5 | 2.00 | - | - |
| Beryllium | 7440-41-7 | µg/L | 2 | 0.13 | - | - |
| Cadmium | 7440-43-9 | µg/L | 2 | 0.15 | 2 | 0.15 |

**Commented [SJ186]:** Mark Loomis: Providing all information missing from this draft, including identification of subcontractors and analytical laboratories that are currently identified as "TBD", and adding the analytical laboratory Standard Operating Procedures (SOPs) to Appendix A;

**Commented [EJ187R186]:** updated

Table 7~~6~~. Method Reporting Limits

*Cuyahoga River Gorge Dam GLLA Project, Cuyahoga Falls, Ohio*

| Parameter | CAS No. | Unit | Achievable Laboratory Limits | | | |
|---|---|---|---|---|---|---|
| | | | Effluent/~~Elutriate~~ Aqueous | | Groundwater | |
| | | | RL | MDL | RL | MDL |
| Calcium | 7440-70-2 | µg/L | 500 | 250.00 | - | - |
| Chromium | 7440-47-3 | µg/L | 5 | 0.61 | - | - |
| Cobalt | 7440-48-4 | µg/L | 5 | 0.13 | - | - |
| Copper | 7440-50-8 | µg/L | 5 | 2.00 | - | - |
| Iron | 7439-89-6 | µg/L | 80 | 50.00 | - | - |
| Lead | 7439-92-1 | µg/L | 5 | 0.72 | 5 | 0.72 |
| Magnesium | 7439-95-4 | µg/L | 200 | 50.00 | - | - |
| Manganese | 7439-96-5 | µg/L | 5 | 2.50 | - | - |
| Nickel | 7440-02-0 | µg/L | 5 | 0.90 | - | - |
| Potassium | 7440-09-7 | µg/L | 200 | 34.00 | - | - |
| Selenium | 7782-49-2 | µg/L | 5 | 0.46 | - | - |
| Silver | 7440-22-4 | µg/L | 5 | 0.84 | - | - |
| Sodium | 7440-23-5 | µg/L | 200 | 44.60 | - | - |
| Thallium | 7440-28-0 | µg/L | 5 | 0.15 | - | - |
| Vanadium | 7440-62-2 | µg/L | 5 | 0.70 | - | - |
| Zinc | 7440-66-6 | µg/L | 10 | 4.70 | - | - |
| Mercury | 7439-97-6 | µg/L | 0.2 | 0.16 | - | - |
| ***Total Suspended Solids by SM 2540 D*** | | | | | | |
| TSS | — | mg/L | 0.6 | 0.38 | - | - |
| ***pH by SW-846 9040*** | — | pH units | 0.1 | 10 | - | - |
| ***Alkalinity by SM 2320B*** | — | mg/L | 10.0 | 8.37 | - | - |
| ***PAHs by SW-846 8270*** | | | | | | |
| Acenaphthene | 83-32-9 | µg/L | - | - | 0.1 | 0.081 |
| Acenaphthylene | 208-96-8 | µg/L | - | - | 0.1 | 0.075 |
| Anthracene | 120-12-7 | µg/L | - | - | 0.1 | 0.028 |
| Benzo[a]anthracene | 56-55-3 | µg/L | - | - | 0.1 | 0.099 |
| Benzo[a]pyrene | 50-32-8 | µg/L | - | - | 0.1 | 0.044 |
| Benzo[b]fluoranthene | 205-99-2 | µg/L | - | - | 0.1 | 0.051 |
| Benzo[g,h,i]perylene | 191-24-2 | µg/L | - | - | 0.1 | 0.030 |
| Benzo[k]fluoranthene | 207-08-9 | µg/L | - | - | 0.1 | 0.048 |

**Commented [SJ186]:** Mark Loomis: Providing all information missing from this draft, including identification of subcontractors and analytical laboratories that are currently identified as "TBD", and adding the analytical laboratory Standard Operating Procedures (SOPs) to Appendix A;

**Commented [EJ187R186]:** updated

Table ~~6~~7. Method Reporting Limits
*Cuyahoga River Gorge Dam GLLA Project, Cuyahoga Falls, Ohio*

| | | | Achievable Laboratory Limits | | | |
|---|---|---|---|---|---|---|
| | | | Effluent/ ~~Elutriate~~ Aqueous | | Groundwater | |
| Parameter | CAS No. | Unit | RL | MDL | RL | MDL |
| Chrysene | 218-01-9 | µg/L | - | - | 0.1 | 0.048 |
| Dibenzo[a,h]anthracene | 53-70-3 | µg/L | - | - | 0.1 | 0.073 |
| Fluoranthene | 206-44-0 | µg/L | - | - | 0.1 | 0.038 |
| Fluorene | 86-73-7 | µg/L | - | - | 0.1 | 0.051 |
| Indeno[1,2,3-c,d]pyrene | 193-39-5 | µg/L | - | - | 0.1 | 0.067 |
| Naphthalene | 91-20-3 | µg/L | - | - | 0.1 | 0.067 |
| Phenanthrene | 85-01-8 | µg/L | - | - | 0.1 | 0.081 |
| Pyrene | 129-00-0 | µg/L | - | - | 0.1 | 0.036 |

[a] 2,2-Oxybis-1-chloropropane will be analyzed by EPA method SW-846 8270
[b] 1,2-Dibromo-3-chloropropane will be analyzed by EPA method SW-846 8260

**Commented [SJ186]:** Mark Loomis: Providing all information missing from this draft, including identification of subcontractors and analytical laboratories that are currently identified as "TBD", and adding the analytical laboratory Standard Operating Procedures (SOPs) to Appendix A;

**Commented [EJ187R186]:** updated

Table 87. Summary of Chemical Analyses and Estimated Sample Quantities

*Cuyahoga River Gorge Dam GLLA Project, Cuyahoga Falls, Ohio*

| Analysis | Extraction and Analysis Methods | Field Samples | QA/QC Samples | | | | Total No. of Samples[b] |
|---|---|---|---|---|---|---|---|
| | | | FD | MS/MSD[a] | EB | PES | |
| **Water (Effluent)** | | | | | | | |
| VOC | SW-846 8260 | 8 | 1 | 1/1 | - | - | 11 |
| SVOC | SW-846 8270 | 8 | 1 | 1/1 | - | - | 11 |
| Pesticides | SW-846 8260 | 8 | 1 | 1/1 | - | - | 11 |
| Total Metals (with Hg) | SW-846 6010/6020/7470 | 8 | 1 | 1/1 | - | - | 11 |
| Dissolved Metals (with Hg) | SW-846 6010/6020/7470 | 8 | 1 | 1/1 | - | - | 11 |
| TSS | SM 2540 D | 8 | 1 | 1/1 | - | - | 11 |
| pH | SW-846 9040 | 8 | 1 | 1/1 | - | - | 11 |
| Alkalinity | SM 2320B | 8 | 1 | 1/1 | - | - | 11 |
| **Water (Elutriate)** | | | | | | | |
| VOC | EPA Mod Elutriate | 8 | - | - | - | - | 8 |
| SVOC | EPA Mod Elutriate | 8 | - | - | - | - | 8 |
| Pesticides | EPA Mod Elutriate | 8 | - | - | - | - | 8 |
| Total Metals (with Hg) | EPA Mod Elutriate | 8 | - | - | - | - | 8 |
| Dissolved Metals (with Hg) | EPA Mod Elutriate | 8 | - | - | - | - | 8 |
| TSS | EPA Mod Elutriate | 8 | - | - | - | - | 8 |
| pH | EPA Mod Elutriate | 8 | - | - | - | - | 8 |
| Alkalinity | EPA Mod Elutriate | 8 | - | - | - | - | 8 |
| **Groundwater** | | | | | | | |
| PAH | SW-846 8270 | 6 | 1 | 1/1 | 1 | 1 | 11 |
| Totals Metals (Cd and Pb) | SW-846 6010/6020 | 6 | 1 | 1/1 | 1 | 1 | 11 |
| **Treatability Samples (Bulk Sediment, Clay and Water)** | | | | | | | |
| Polymer and Coagulant Combinations | | 8 | - | - | - | - | 8 |
| Separation and Performance Consistency | | 8 | - | - | - | - | 8 |
| **Waste Characterization (Solid)** | | | | | | | |
| TCLP VOC | SW-846 1311/8260B | 1 | - | - | - | - | 1 |
| TCLP SVOC | SW-846 1311/8270C | 1 | - | - | - | - | 1 |

Table 8~~7~~. Summary of Chemical Analyses and Estimated Sample Quantities
*Cuyahoga River Gorge Dam GLLA Project, Cuyahoga Falls, Ohio*

| Analysis | Extraction and | Field | QA/QC Samples | | | | Total No. of |
|---|---|---|---|---|---|---|---|
| TCLP Pesticides | SW-846 1311/8081B | 1 | - | - | - | - | 1 |
| TCLP Herbicides | SW-846 1311/8151A | 1 | - | - | - | - | 1 |
| TCLP Metals (with Hg) | SW-846 1311/ 6010/6020/7470 | 1 | - | - | - | - | 1 |
| PCBs | SW-846 8082A | 1 | - | - | - | - | 1 |
| pH | SW-846 9045D | 1 | - | - | - | - | 1 |
| Flash point | SW-846 1030 | 1 | - | - | - | - | 1 |
| **Waste Characterization (Aqueous)** | | | | | | | |
| VOC | SW-846 8260B | 1 | - | - | - | - | 1 |
| SVOC | SW-846 8270C | 1 | - | - | - | - | 1 |
| Pesticides | SW-846 8081B | 1 | - | - | - | - | 1 |
| Herbicides | SW-846 8151A | 1 | - | - | - | - | 1 |
| Metals | SW-846 6010/6020/7470A | 1 | - | - | - | - | 1 |
| PCBs | SW-846 8082A | 1 | - | - | - | - | 1 |
| pH | SW-846 9040C | 1 | - | - | - | - | 1 |
| Flash point | SW-846 1010A | 1 | - | - | - | - | 1 |

[a] MS/MSD laboratory requires triplicate volume of sample.

[b] Sample quantities are estimated and subject to change

QA = quality assurance; QC = quality control; MS/MSD = matrix spike matrix spike duplicate sample; VOC = volatile organic compound; SVOC = semivolatile organic compound; PAH = polycyclic aromatic hydrocarbons; Hg = mercury; Cd = cadmium; Pb = lead; TSS = total suspended solids; TCLP = toxicity characteristic leaching procedure

**Table 98. Data Package Deliverables**

*Cuyahoga River Gorge Dam GLLA Project, Cuyahoga Falls, Ohio*

**All Analytical Fractions**

Case Narrative—A detailed case narrative per analytical fraction is required and will include explanation of any noncompliance and/or exceptions and corrective action. Exceptions will be noted for receipt, holding times, methods, preparation, calibration, blanks, spikes, surrogates (if applicable), and sample exceptions.

Sample ID Cross-Reference Sheet (Laboratory ID's and Client ID's)

Completed chain of custody and any sample receipt information

Sample preparation (extraction/digestion/dilution) logs

Copies of nonconformance memorandums and corrective actions

| Form[a] | Organic Fractions | Level III | Level IV |
|---|---|---|---|
| 1 | Sample results with lab sample ID, client sample ID, and station ID | • | • + raw |
| 2 | Surrogate Recovery Summary (w/ applicable control limits) | • | • |
| 3 | MS/MSD Accuracy & Precision Summary[b] (including spike added, percent recovery, and applicable control limits) | • | • + raw |
| 3 | LCS Accuracy Summary (including spike added, percent recovery, and applicable control limits) | • | • + raw |
| 4 | Method Blank Summary | • | • + raw |
| 5 | Instrument Tuning Summary (including tuning summary for applicable initial calibrations) | • | • |
| 6 | Initial Calibration Summary (including concentration levels of standards) | • | • + raw |
| 6 | Initial Calibration Summary (Retention Times [RT], Response or Calibration Factors, and linearity demonstration) | • | • + raw |
| 7 | Continuing Calibration Summary | • | • + raw |
| 7 | Continuing Calibration Summary (unique instrument/column ID, RTs, RT windows, calibration or response factors, percent difference or drift—as appropriate to method) | • | • + raw |
| 8 | Internal Standard Summary (including applicable initial calibrations and analytical sequence) | • | • |
| 8 | Analytical Sequence—For every analysis associated with a particular analytical sequence starting with the initial calibration, enter the client sample identification, lab sample identifier, and date and time of analysis. Each sample analyzed as part of the sequence shall be reported on Form 8 even if it is not associated with the batch/SDG. The laboratory shall use ZZZZZ as the client sample identification to distinguish all samples that are not part of the batch/SDG being reported. | • | • + raw |
| 10 | Compound Identification Summary (where confirmation is required), including RT, RT windows, concentrations for detected compounds on both columns, and percent difference between results | • | • + raw |
| 11 | Complete raw data associated with each sample delivery group | | • |

Table 98. Data Package Deliverables

*Cuyahoga River Gorge Dam GLLA Project, Cuyahoga Falls, Ohio*

| Form[a] | Inorganic Fractions | Level III | Level IV |
|---|---|---|---|
| 1 | Sample Results (with lab ID, sample ID, and station ID) | • | • + raw |
| 2A | Initial and Continuing Calibration Summary | • | • + raw |
| 3 | Initial and Continuing Calibration Blanks and Method Blanks Summary | • | • + raw |
| 5A | Predigestion Matrix Spike Recoveries Summary | • | • + raw |
| 6 | Native Duplicate or MS/MSD Precision Summary | • | • + raw |
| 7 | Laboratory Control Sample Recovery Summary | • | • + raw |
| 10 | Instrument or Method Detection Limit Summary | • | • |
| 13 | Preparation Log Summary | • | • + raw |
| 14 | Analytical Run Sequence and GFAA Post-spike Recovery Summary (as appropriate to method) | • | • + raw |
| 15 | Complete raw data associated with each sample delivery group | | • |

[a] Contract laboratory program form or summary form with equivalent information.

[b] With RPD calculated according to method specifications (contract laboratory program using percent recovery, SW-846 using concentration).

Figures

# Appendix A

## *Data Gaps Assessment—Cuyahoga River Gorge Dam Great Lakes Legacy Act Project, Cuyahoga Falls, Ohio Technical Memorandum*

**Commented [GMB188]:** Attach to SAP.

**Commented [SJ189R188]:** Added Data Gap TM

# Appendix B
# Analytical Laboratory Standard Operating Procedures

# Appendix C~~B~~
# Field Operating Procedures